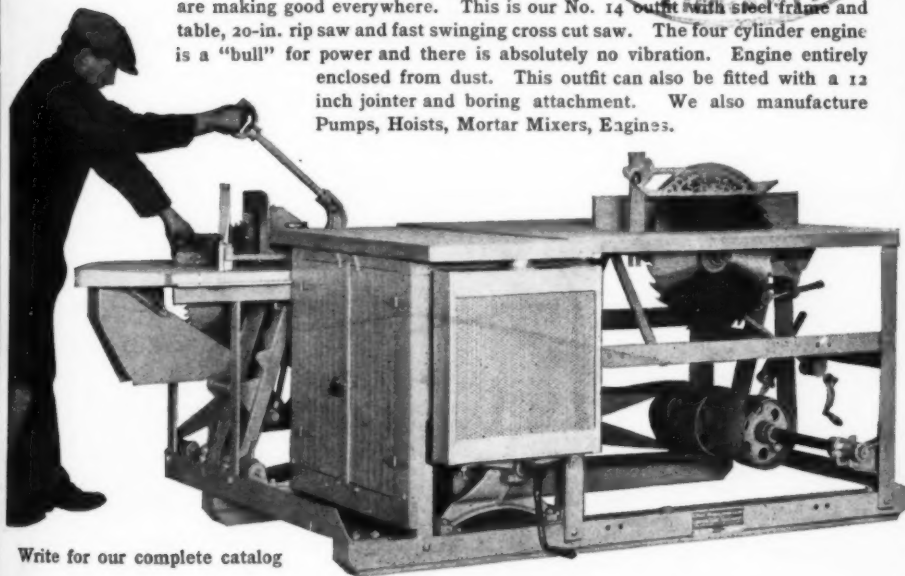


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# Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers, water-works superintendents, municipal and county engineering departments, street and highway officials, city managers, etc., and public officials who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (\*) it indicates that the user of the directory may secure further information by referring to the manufacturer's advertisement in this issue. The index to advertisers will be found on page facing the inside back cover.

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## ACETYLENE APPARATUS

Air Reduction Sales Co., New York.  
Oxweld Acetylene Co., Newark, N. J.

## ADDING MACHINES. (See Calculating Machines.)

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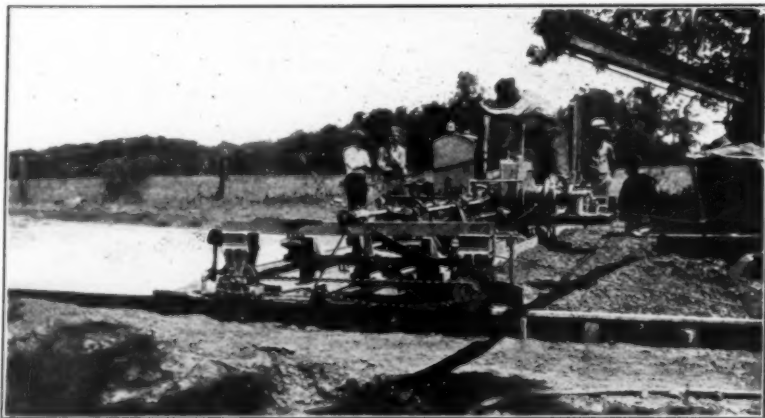
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Bethlehem Steel Co., Bethlehem, Pa.  
Carbon Steel Co., Pittsburgh, Pa.  
Carnegie Steel Co., Pittsburgh, Pa.  
Franklin Steel Works, Franklin, Pa.  
Gulf States Steel Co., Birmingham, Ala.  
Hirsch Rolling Mill Co., St. Louis, Mo.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.



## Mile-a-Week Road Builder



A Dunn Finisher on W. H. Friederich & Co.'s road job, near Marshall, Mich.

## They Are Buying the Dunn Road Builder

Recently we received orders for five Dunn Mile-A-Week Road Builders in a single day. These orders came from Michigan and were in addition to eight others which we had already received from there.

This machine strikes off, spades, tamps and finishes very dry mix in one trip over the concrete. It leaves a slab that is ideal for sustaining the tremendous strain of modern highway traffic.

It does not displace or injure the forms. For example: On one of these Michigan jobs, one of our

heaviest machines has been running on eight-inch forms which are in ten foot section. There are only two stakes to the section. Yet in spite of this light support the forms were not affected in any way.

The Dunn Mile-A-Week Road Builder is designed to meet the requirements of painstaking contractors. It does work that is a lasting credit to its owner. It cuts costs. It is built for years of service. Because of the extra value you get, it is simply good business to put one of these machines on your job.

*Manufactured by*

**THE DUNN ROAD MACHINERY CO.**  
CONNEAUT, OHIO

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WAY, BUT—



EASY ON A TRACK  
THE CLETRAC WAY

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*Write us for additional convincing facts and  
figures on the Model "W" Industrial Cletrac*

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*Largest Producers of Crawler Tractors in the World*

19211 Euclid Avenue

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Pulling Ditching Machines  
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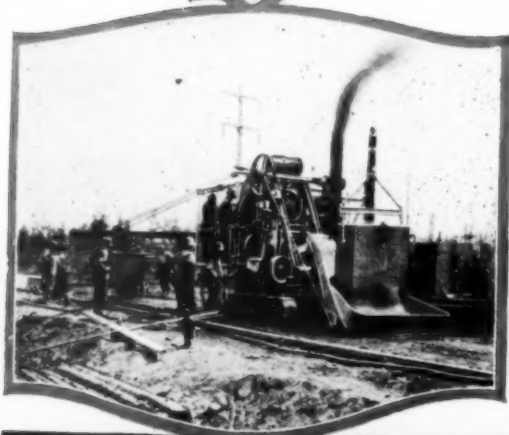
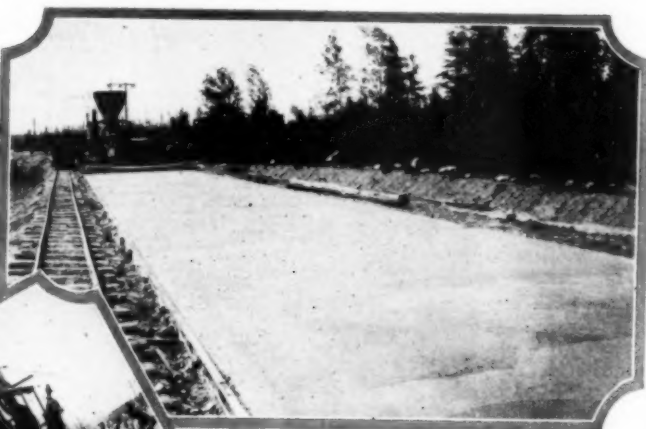
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Greenfield Tap & Die Corp'n., Greenfield, Mass.  
Oswego Tool Co., Oswego, N. Y.  
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Walworth Mfg. Co., Boston, Mass.

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Worthington Pump & Mch. Corp., New York.  
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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Federal Bridge & Struc. Co., Waukesha, Wis.  
Flory Mfg. Co., S., Bangor, Pa.  
Inaley Mfg. Co., Indianapolis, Ind.  
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.  
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Austin Machinery Corp'n., Chicago, Ill.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Federal Bridge & Struc. Co., Waukesha, Wis.  
Hayward Co., New York.  
Inaley Mfg. Co., Indianapolis, Ind.  
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.  
Lidgerwood Manufacturing Co., New York.  
Taylor Portable Steel Derrick Co., Chicago, Ill.

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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Lidgerwood Manufacturing Co., New York.  
Taylor Portable Steel Derrick Co., Chicago, Ill.

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Byers Machine Co., Ravenna, Ohio.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
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Lakewood Engineering Co., Cleveland, O.  
Ransome Concrete Machy. Co., Dunellen, N. J.

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McFarland Co., J. C., La Porte, Ind.  
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Hayward Co., New York.  
Lidgerwood Mfg. Co., New York.  
Marion Steam Shovel Co., Marion, O.  
Osgood Co., The, Marion, O.  
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Superior Iron Works, Superior, Wis.  
Vulcan Iron Works, Jersey City, N. J.

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\*Bay City Dredge Works, Bay City, Mich.  
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Austin Machinery Corp'n., Chicago, Ill.  
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Marion Steam Shovel Co., Marion, O.  
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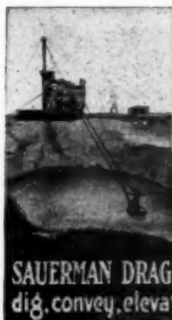
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Marion Steam Shovel Co., Marion, O.  
Morris Machine Works, Baldwinville, N. Y.

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Cleveland Rock Drill Co., Cleveland, Ohio.  
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Haughton Elev. & Mach. Co., Toledo, Ohio.  
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Montgomery Elevator Co., Moline, Ill.  
Otis Elevator Co., New York.  
Ridgeway & Son Co., C., Coatesville, Pa.  
See Elec. Elevator Co., A. B., New York.  
Speidel, J. G., Reading, Pa.  
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PROVED AND  
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JOINT



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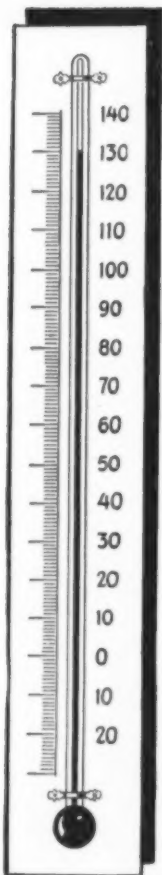
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Elastite takes up the stress of expansion without squeezing out of the joint, its tempered asphalt base being highly compressible in its own volume. No ordinary asphalt joint will do this effectively

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Nordberg Mfg. Co., Milwaukee, Wis.

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Anderson Fdry. & Mach. Co., Anderson, Ind.  
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Evinrude Motor Co., Milwaukee, Wis.  
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Filer-Stowell Co., Milwaukee, Wis.  
Hardie-Tynes Mfg. Co., Birmingham, Ala.  
Lefel Co., J., Springfield, O.  
Morris Machine Works, Baldwinville, N. Y.  
Murray Iron Works Co., Burlington, Ia.  
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Austin Machinery Corp'n, Chicago, Ill.  
Byers Machine Co., Ravenna, Ohio.  
Ball Engine Co., Erie, Pa.  
Buckeye Traction Ditcher Co., Findlay, O.

Bucyrus Co., South Milwaukee, Wis.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Economy Excavator Co., Iowa Falls, Ia.  
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Fairbanks Steam Shovel Co., Marion, O.  
Hayward Co., The, New York City.  
Marion Steam Shovel Co., Marion, O.  
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Browning Co., Cleveland, O.  
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Byers Machine Co., Ravenna, Ohio.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Economy Excavator Co., Iowa Falls, Ia.  
Erie Steam Shovel Co., Erie, Pa.  
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Hayward Co., New York.  
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Osgood Co., Marion, O.  
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\*Waring-Underwood Co., Philadelphia, Pa.  
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International Motor Co., New York.  
Pirsch & Sons Co., Peter, Kenosha, Wis.  
Prospect Mfg. Co., Prospect, O.  
Seagrave Co., Columbus, O.  
Stutz Fire Engine Co., Indianapolis, Ind.  
Waterous Fire Engine Co., St. Paul, Minn.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

# GRADER AND DRAG BLADES

## also SCARIFIER TEETH

Made of high grade plow steel. We carry a large stock for all makes of road graders. We sell through Agents. Let us prove to you the merits of our product.

*Manufactured by*  
**Shunk Manufacturing Company, Bucyrus, Ohio**

## MAKE YOUR CONCRETE ROADS SMOOTH REPAIR THOSE CRACKS AND JOINTS WITH

# ROAD SOLDER.

TRADE MARK

MANUFACTURED AND SOLD BY

**THE WARING-UNDERWOOD COMPANY**  
COMMERCIAL TRUST BUILDING PHILADELPHIA, PA.

## FIRST MILE PAYS FOR IT



The second mile is 100% profit. That is the verdict of road contractors who use the

### BURCH Stone Spreader

Lays gravel, slag or stone evenly at required depth and width from the end of the truck. Saves time, trouble and wages. Let us tell you what contractors have saved by its use.

**THE BURCH PLOW WORKS CO.,** Dept. E, CRESTLINE, OHIO

## Closer Bidding

**YOU** can bid closer than the other fellow on any rock excavation job if you standardize on Waugh drills sharpeners, hoists, and portable compressors, because of the sure and healthy margin of profit in Waugh efficiency.

Make your next rock job "all-Waugh."  
"The Waugh Way Wins"

**THE Denver Rock Drill Mfg. Co.**

DENVER, COLORADO

## TRUSCON CURB BARS

Protect and reinforce concrete curbs. Positive anchorage is assured; there is no separating or splitting of the concrete at the corners. Owing to their rigidity and

convenient size, Truscon Curb Bars are easy to handle and install. Furnished straight or curved.



### TRUSCON STEEL COMPANY

Youngstown, Ohio

*Warehouses and Representatives in  
Principal Cities*



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American-La France Fire Eng. Co., Elmira, N. Y.  
Childs Co., O. J., Utica, N. Y.  
Cross Mfg. Co., O. J., Inc., New York.  
Foamite Firefoam Co., New York.  
Pyrene Mfg. Co., New York.

## FIREPROOF BUILDING MATERIAL

\*Truscon Steel Co., Youngstown, O.  
Berger Mfg. Co., Canton, O.  
Corrugated Bar Co., Inc., Buffalo, N. Y.  
Delaware Clay Products Co., Pittsburgh, Pa.  
Detroit Steel Prod. Co., Detroit, Mich.  
General Fireproofing Co., Youngstown, O.  
Kearney & Mattison Co., Ambler, Pa.  
Kinnear Mfg. Co., Columbus, O.  
National Fireproofing Co., Pittsburgh, Pa.  
United States Gypsum Co., Chicago, Ill.  
Youngstown Pressed Steel Co., Warren, O.

## FIRST AID EQUIPMENT

American-La France Fire Eng. Co., Elmira, N. Y.

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\*Central Foundry Co., New York.  
\*U. S. O. I. Pipe & Fdry Co., Burlington, N. J.  
Coldwell-Wilcox Co., Newburgh, N. Y.  
Crane Co., Chicago, Ill.  
Lunkenheimer Co., Cincinnati, O.  
United Lead Company, New York.

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\*Barber Asphalt Co., Philadelphia, Pa.  
Am. Mason Safety Tread Co., Lowell, Mass.  
Barrett Co., New York.  
Johns-Manville Co., H. W., New York.  
Marine Decking & Supply Co., Phila., Pa.  
Muller, Franklin R., & Co., Waukegan, Ill.  
Special Service Flooring Corp., New York.

## FLOORS, WOOD BLOCK

Barrett Co., New York.  
Jennison-Wright Co., Toledo, O.  
Midland Creosoting Co., Toledo, O.  
Republic Creosoting Co., Indianapolis, Ind.  
Southern Wood Pres. Co., Atlanta, Ga.  
Wyckoff Pipe & Creosoting Co., New York.

## FLUSH TANKS

Pacific Flush Tank Co., Chicago, Ill.

## FLUSHERS, STREET. (See Street Flushers and Sprinklers.)

## FORGES

Buffalo Forge Co., Buffalo, N. Y.  
Hauck Mfg. Co., Brooklyn, N. Y.

## FORM CLAMPS

Inaley Mfg. Co., Indianapolis, Ind.  
Marion Malleable Iron Works, Marion, Ind.  
Universal Form Clamp Co., Chicago, Ill.

## FORMS, CONCRETE

\*Connelly & Co., Philadelphia, Pa.  
\*Reichert Metal Concrete Forms Co., Milwaukee, Wis.

## \*Truscon Steel Co., Youngstown, O.

Blaw-Knox Co., Pittsburgh, Pa.  
Concrete Form Co., Inc., Syracuse, N. Y.  
Heltzel Steel Form & Iron Co., Warren, O.  
Hydraulic Steelcraft Co., Cleveland, O.  
Lakewood Eng. Co., Cleveland, Ohio.  
Metal Forms Corp., Milwaukee, Wis.

## FOUNTAINS, DRINKING

Clow & Sons, Jas. B., Chicago, Ill.  
Crane Co., Chicago, Ill.  
Mott Iron Wks., J. L., New York.  
Murdock Mfg. & Supply Co., Cincinnati, Ohio.  
Puro Sanitary Drinking Fountain Co., Haydensville, Mass.  
Rundle-Spence Mfg. Co., Milwaukee, Wis.  
Stewart Iron Works Co., Cincinnati, O.  
Taylor Co., Halsey W., Warren, O.  
Twentieth Century Brass Wks., Belleville, Ill.

## FURNITURE AND FILES, STEEL

Art Metal Constr. Co., Jamestown, N. Y.  
General Fireproofing Co., Youngstown, O.  
Van Dorn Iron Works Co., Cleveland, O.

## GARBAGE CANS. (See Cans)

## GARBAGE DISPOSAL

Balmer Corp., New York.  
Cobwell Corp., Cleveland, O.  
Cummer & Son Co., F. P., Cleveland, O.  
Decarie Incinerator Co., Minneapolis, Minn.  
Destructor Co., New York.  
Jeffrey Manufacturing Co., Columbus, O.  
Morse-Boulger Destructor Co., New York.  
Nye Odorless Crematory Co., Macon, Ga.

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\*Autocar Co., Ardmore, Pa.

## \*Hell Co., Milwaukee, Wis.

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Four Wheel Drive Auto Co., Clintonville, Wis.  
Holsbrog & Bro., Geo. H., Jeffersonville, Ind.  
International Motor Co., New York.  
Lee Trailer & Body Co., Chicago, Ill.  
Service Motor Truck Co., Wabash, Ind.  
Tiffin Wagon Co., Tiffin, O.  
Watson Products Corp., Canastota, N. Y.  
White Co., Cleveland, O.

## GAS ENGINES. (See Engines, Gas and Gasoline.)

## GAS METERS

Builders Iron Foundry, Providence, R. I.  
General Electric Co., Schenectady, N. Y.  
Pittsburgh Meter Co., East Pittsburgh, Pa.

## GAS PRODUCERS

Camden Iron Works, Camden, N. J.  
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## GASOLINE STORAGE TANKS

\*Hell Co., Milwaukee, Wis.  
\*Littleford Bros., Cincinnati, O.  
Biggs Boiler Works, Akron, Ohio.  
Bowser & Co., Inc., S. F., Fort Wayne, Ind.  
Byers Machine Co., Ravenna, Ohio.  
Chicago Bridge & Iron Works, Chicago, Ill.  
Honhorst Co., Jos., Cincinnati, O.  
Scaife & Sons, Wm. B., Oakmont, Pa.  
United Iron Works, Kansas City, Mo.  
Wayne Tank & Pump Co., Ft. Wayne, Ind.

## GATES, SLUICE

\*Ludlow Valve Mfg. Co., Troy, N. Y.  
Chapman Valve Mfg. Co., Indian Orchard, Mass.  
Coffin Valve Co., Boston, Mass.  
Coldwell-Wilcox Co., Newburgh, N. Y.  
Columbian Iron Works, Chattanooga, Tenn.  
Crane Co., Chicago, Ill.  
Eddy Valve Co., Watford, N. Y.  
Hardisty Mfg. Co., E., Denver, Col.  
Kennedy Valve Mfg. Co., Elmira, N. Y.  
Rensselaer Valve Co., Troy, N. Y.  
Wood & Co., R. D., Philadelphia, Pa.

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Ashcroft Mfg. Co., Bridgeport, Conn.  
Bristol Co., Waterbury, Conn.  
Crosby Steam Gauge & Valve Co., Boston, Mass.  
Marsh & Co., Jas. P., Chicago, Ill.  
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.  
U. S. Gauge Co., New York

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Bristol Co., Waterbury, Conn.  
Clow & Sons, J. B., Chicago, Ill.  
Lunkenheimer Co., Cincinnati, O.  
United States Gauge Co., New York.  
Walworth Mfg. Co., Boston, Mass.

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\*Clark Co., H. W., Mattoon, Ill.  
Builders Iron Foundry, Providence, R. I.  
Simplex Valve & Meter Co., Philadelphia, Pa.

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\*Austin-Western Road Mch. Co., Chicago, Ill.  
\*Baker Mfg. Co., Springfield, Ill.  
\*Good Roads Mach'y Co., Kennett Square, Pa.  
\*Holt Mfg. Co., Peoria, Ill.  
\*Koehring Co., Milwaukee, Wis.  
Adams & Co., J. D., Indianapolis, Ind.  
Case Threshing Machine Co., J. I., Racine, Wis.  
Galcon Iron Works & Mfg. Co., Galion, Ohio.  
Kilbourne & Jacobs Mfg. Co., Columbus, O.  
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.  
Russell Grader Mfg. Co., Minneapolis, Minn.  
Smith & Sons Mfg. Co., Kansas City, Mo.  
Stockland Road Machine Co., Minneapolis, Minn.

## GRADER BLADES

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Cleveland Pneumatic Tool Co., Cleveland, Ohio.  
Ingersoll-Rand Co., New York, N. Y.

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## HAMMER DRILLS

(See Drills, Hammer.)

## HAMMERS, STEAM, PILE. (See Pile Hammers, Steam)

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\*Carey Co., Philip, Cincinnati, Ohio.  
Johns-Manville, Inc., New York

## HEATERS AND DISTRIBUTORS, TAR AND ASPHALT HEATING KETTLES

\*Kinney Mfg. Co., Boston, Mass.



Conveyors  
Elevators  
Storage Bins  
(Bin Gates)  
Screens  
  
Car Pullers  
Power Shovels  
Friction Clutches  
Gears  
  
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Coal and Ash Handling  
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In this plant the material is received in hopper bottom cars, dumped in pit from where it is carried by bucket elevator to top of bins and distributed by belt conveyors.

The saving by using

**Weller Equipment**

Soon Pays for the Installation

**Have You**

A material handling problem? Refer it to us. Tell us what you want to handle. There is no obligation on your part.

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## Expansion Joint

Every monolithic pavement should have an Expansion Joint. They are placed to take care of expansion and contraction. "PIONEER" Expansion Joint is produced from an absolutely pure asphalt, giving maximum efficiency. Specified, recommended and used by engineers and contractors who take pride in their work and still believe in quality.

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## Filler Asphalt

The highest quality of asphalt filler produced. Makes ideal brick pavements. Low prices and immediate delivery on any quantity. Made to meet the strictest filler specifications.

**THE PIONEER ASPHALT CO.,**

**Lawrenceville, Ill.**

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- \*Pawling & Harnischfeger Co., Milwaukee, Wis.
- \*Weller Mfg. Co., Chicago, Ill.
- American Hoist & Derrick Co., St. Paul, Minn.
- Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Lidgerwood Mfg. Co., New York.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Mundy Hoisting Engine Co., J. S., Newark, N. J.

### HOISTS, CONCRETE, TOWER

- Insley Mfg. Co., Indianapolis, Ind.
- Lakewood Engineering Co., Cleveland, O.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Ransome Concrete Machy. Co., Dunellen, N. J.

### HOISTS, ELECTRIC

- \*C. H. & E. Mfg. Co., Milwaukee, Wis.
- \*Pawling & Harnischfeger Co., Milwaukee, Wis.
- American Hoist & Derrick Co., St. Paul, Minn.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Flory Mfg. Co., S. Bangor, Pa.
- Lidgerwood Mfg. Co., New York.
- Link-Belt Co., Chicago, Ill.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Mundy Hoisting Eng. Co., J. S., Newark, N. J.
- National Hoisting Engine Co., Harrison, N. J.
- Patten Mfg. Co., Chattanooga, Tenn.
- Treadwell Eng. Co., Easton, Pa.

### HOISTS, GASOLINE

- \*C. H. & E. Mfg. Co., Milwaukee, Wis.
- \*Pawling & Harnischfeger Co., Milwaukee, Wis.
- American Cement Mach. Co., Keokuk, Ia.
- Austin Machinery Corp'n, Chicago, Ill.
- Buffalo Hoist & Derrick Co., Buffalo, N. Y.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Construction Machy. Co., Waterloo, Iowa.
- Domestic Engine & Pump Co., Shippensburg, Pa.
- Flory Mfg. Co., S. Bangor, Pa.
- Lansing Co., Lansing, Mich.
- Lidgerwood Mfg. Co., New York.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Monaghan Machine Co., Chicago, Ill.
- Mundy Hoisting Engine Co., J. S., Newark, N. J.
- National Hoisting Engine Co., Harrison, N. J.
- O. K. Clutch & Mach. Co., Columbia, Pa.
- Orr & Semberower, Reading, Pa.
- Patten Mfg. Co., Chattanooga, Tenn.
- Schramm & Son, Inc., Chris. D., West Chester, Pa.
- Standard Scale & Supply Co., Pittsburgh, Pa.

### HOISTS, PNEUMATIC

- \*Denver Rock Drill Mfg. Co., Denver, Colo.
- Chicago Pneumatic Tool Co., New York.
- Detroit Hoist & Machine Co., Detroit, Mich.
- Flory Mfg. Co., S. Bangor, Pa.
- Hanna Eng. Works, Chicago, Ill.
- Independent Pneumatic Tool Co., Chicago, Ill.
- Ingersoll-Rand Co., New York.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Northern Engineering Works, Detroit, Mich.
- Worthington Pump & Machy. Corp., New York.

### HOISTS, STEAM

- \*Denver Rock Drill Mfg. Co., Denver, Colo.
- American Hoist & Derrick Co., St. Paul, Minn.
- Austin Machinery Corp'n, Chicago, Ill.
- Ayers Machine Co., Ravenna, Ohio.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Flory Mfg. Co., S. Bangor, Pa.
- Hardie-Tynes Mfg. Co., Birmingham, Ala.
- Ingersoll-Rand Co., New York.
- Insley Mfg. Co., Indianapolis, Ind.
- Lidgerwood Mfg. Co., New York.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Mundy Hoisting Eng. Co., J. S., Newark, N. J.
- National Hoisting Engine Co., Harrison, N. J.
- Orr & Semberower, Reading, Pa.
- Treadwell Eng. Co., Easton, Pa.

### HOISTS FOR MOTOR TRUCKS

- \*Heil Co., The Milwaukee, Wis.
- Horizontal Hydr. Hoist Co., Detroit, Mich.
- Perfection Hoist & Engine Co., Two Rivers, Wis.
- Wood Hydr. Hoist & Body Co., Detroit, Mich.

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- Dee Co., Wm. E., Chicago, Ill.
- Delaware Clay Products Co., Pittsburgh, Pa.
- Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
- Medal Paving Brick Co., Cleveland, Ohio.
- Metropolitan Paving Brick Co., Canton, Ohio.
- National Fireproofing Co., Pittsburgh, Pa.

### HOPPERS, CONCRETE

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## \*Littleford Bros., Cincinnati, O.

- \*Weller Mfg. Co., Chicago, Ill.
- Insley Mfg. Co., Indianapolis, Ind.
- Lakewood Engineering Co., Cleveland, O.
- Ransome Concrete Machy. Co., Dunellen, N. J.

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- Cincinnati Rubber Mfg. Co., Cincinnati, O.
- Goodyear Tire & Rubber Co., Akron, O.
- Ingersoll-Rand Co., New York.
- Penna Flexible Metallic Tubing Co., Phila., Pa.
- Republic Rubber Co., Youngstown, O.
- U. S. Rubber Co., New York

### HOSE, FIRE

- Bi-Lateral Fire Hose Co., Chicago, Ill.
- Fabric Fire Hose Co., New York.
- Goodrich Rubber Co., B. F., Akron, Ohio.
- Goodyear Tire & Rubber Co., Akron, Ohio.
- U. S. Rubber Co., New York.

### HOUSES, PORTABLE. (See Buildings, Portable)

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- Chapman Valve Mfg. Co., Indian Orchard, Mass.
- Columbian Iron Works, Chattanooga, Tenn.
- Darling Valve Mfg. Co., Williamsport, Pa.
- Eddy Valve Mfg. Co., Watford, N. Y.
- Iowa Valve Co., Okla., Ia.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Norwood Engineering Co., Florence, Mass.
- Rensselaer Valve Co., Troy, N. Y.
- Smith Mfg. Co., A. P., East Orange, N. J.
- Wood & Co., K. D., Philadelphia, Pa.

### INCINERATORS, GARBAGE. (See Garbage Disposal)

### INDICATOR POSTS. (See Valves)

### INSPECTING LABORATORIES

- \*Conard & Busby, Burlington, N. J.
- Allentown Testing Laboratories, Allentown, Pa.
- Gulick-Henderson Co., New York.
- Hunt & Co., Robert W., Chicago, Ill.
- Pittsburgh Testing Laboratories, Pittsburgh, Pa.

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- Berger & Sons, C. L., Boston, Mass.
- Brandis & Sons Mfg. Co., Brooklyn, N. Y.
- Buff & Buff Mfg. Co., Boston, Mass.
- Dietsgen Co., Eugene, Chicago, Ill.
- Gurley, W. & L. E., Troy, N. Y.
- Kenfelf & Esser Co., Hoboken, N. J.
- Kolesch & Co., New York.
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- Lenpold & Voelpel, Portland, Ore.
- Plister, Wm. H., Cincinnati, O.
- Ulmer, J. C. Co., Cleveland, Ohio.
- Weber & Co., F., Philadelphia, Pa.
- White Co., David, Milwaukee, Wis.
- Wissler Instrument Co., St. Louis, Mo.

### IRON WORK, STRUCTURAL AND ORNAMENTAL (See Bridges and Buildings)

### JACKS, LIFTING

- \*McKiernan-Terry Drill Co., New York.
- Buda Company, Chicago, Ill.
- Duff Mfg. Co., Pittsburgh, Pa.
- Joyce-Cridland Co., Dayton, O.
- Kalamazoo Railway Supply Co., Kalamazoo, Mich.
- Norton, Inc., A. O., Boston, Mass.
- Rees Mfg. Co., Pittsburgh, Pa.
- Watson-Hillman Company, New York.

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- Stewart Iron Works Co., Cincinnati, Ohio.
- Van Dorn Iron Works Co., Cleveland, O.

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- \*Pioneer Asphalt Co., Lawrenceville, Ill.
- \*Waring-Underwood Co., Philadelphia, Pa.

### JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

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- \*Barber Asphalt Co., Philadelphia, Pa.
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- \*Good Roads Machinery Co., Kennett Square, Pa.
- \*Kinney Mfg. Co., Boston, Mass.
- \*Littleford Bros., Cincinnati, O.
- Hauck Mfg. Co., Brooklyn, N. Y.
- Honhorst Co., Jos., Cincinnati, Ohio.
- Macleod Co., Cincinnati, O.
- Stuebner Iron Wks., G. L., Long Island City, N. Y.



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tractor with astounding results. 300 to 500 yards a day is common practice. Made also for horses in three sizes.



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585 Stanford Ave.

Springfield, Illinois

YOU can move dirt at a very low cost per yard with these "self-loaders." Excellent for road work and stripping operations. Three to six one yard scrapers can be used in train behind

*Special Service to Contractors who are about to purchase equipment.*

Turn to pages 61 and 62 and check off such catalogs or price lists as you would like to secure and mail the sheet to us.

*The desired material will be sent you promptly and you will be saved the necessity of writing a lot of letters*

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### Paving Tools

Asphalt Tampers  
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Asphalt Rakes  
Tool Heaters  
Tar Kettles  
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Brick Filling Pots  
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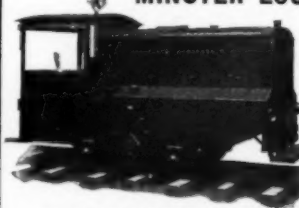


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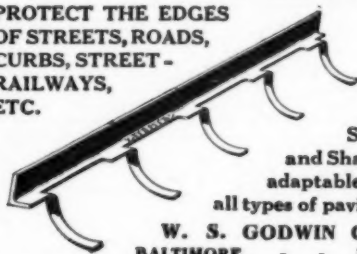
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PROTECT THE EDGES OF STREETS, ROADS, CURBS, STREET-RAILWAYS, ETC.



Sizes and Shapes adaptable to all types of paving.

**W. S. GODWIN CO.**

BALTIMORE, - - MD.

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23

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Union Iron Wks., Hoboken, N. J.

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\*Truscon Steel Co., Youngstown, O.  
Berger Mfg. Co., Canton, O.  
Bostwick Steel Lath Co., Niles, O.  
Consol. Expanded Metal Co., Braddock, Pa.  
Corrugated Bar Co., Inc., Buffalo, N. Y.  
General Fireproofing Co., Youngstown, O.  
Milwaukee Corrugating Co., Milwaukee, Wis.  
Northwestern Expanded Metal Co., Chicago, Ill.  
Penn Metal Co., Boston, Mass.  
Sykes Metal Lath & Roofing Co., Niles, O.  
Wickwire Spencer Steel Corp., Worcester, Mass.  
Youngstown Pressed Steel Co., Warren, O.

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Coldwell Lawn Mower Co., Newburgh, N. Y.  
Gilson Mfg. Co., Port Washington, Wis.  
Ideal Power Lawn Mower Co., Lansing, Mich.  
Jacobson Mfg. Co., Racine, Wis.  
Penna. Lawn Mower Works, Philadelphia, Pa.  
Philadelphia Lawn Mower Co., Philadelphia, Pa.  
Townsend Co., S. P., Bloomfield, N. J.  
Worthington Mower Co., Shawnee, Pa.

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Leadite Co., The, Philadelphia, Pa.

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\*Littleford Bros., Cincinnati, O.  
\*Smith Mfg. Co., A. P., E. Orange, N. J.  
Canton Fdry & Machy Co., Canton, O.  
Chicago Flexible Shaft Co., Chicago, Ill.  
Focht's Sons, Geo., Hoboken, N. J.  
Hauck Mfg. Co., Brooklyn, N. Y.

### LEAK FINDERS

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### LETTERS AND FIGURES, METAL

Niagara Metal Stamp Corp., Niagara Falls, N. Y.

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Carbie Mfg. Co., Duluth, Minn.  
General Electric Co., Schenectady, N. Y.  
Hauck Mfg. Co., Brooklyn, N. Y.  
Macleod Co., Cincinnati, O.  
Milburn Co., Alex., Baltimore, Md.

### LIGHTING STANDARDS. (See Street Lamp Posts)

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Electro Bleaching Gas Co., New York.  
Mathieson Alkali Works, Inc., New York.

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\*Hais Mfg. Co., Geo., New York.  
\*Portable Machinery Co., Passaic, N. J.  
\*Sauerman Bros., Chicago, Ill.  
\*Smith Co., T. L., Milwaukee, Wis.  
\*Weller Mfg. Co., Chicago, Ill.  
Atlas Engineering Co., Milwaukee, Wis.  
Austin Machinery Corp'n, Chicago, Ill.  
Bacon Co., Edw. R., San Francisco, Cal.  
Barber-Greene Co., Aurora, Ill.  
Bonney Supply Co., Inc., Rochester, N. Y.  
Chain Belt Co., Milwaukee, Wis.  
Economy Excavator Co., Iowa Falls, Iowa.  
Fairfield Engineering Co., Lancaster, Ohio.  
Gifford-Wood Co., Hudson, N. Y.  
Jeffrey Mfg. Co., Columbus, O.  
Lee Trailer & Body Co., Chicago, Ill.  
Link-Belt Co., Chicago, Ill.  
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.  
Sackett Screen & Chute Co., H. B., Chicago, Ill.

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East Jersey Pipe Co., New York.

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Hart & Hutchinson Co., New Britain, Conn.  
Medart Mfg. Co., Fred., St. Louis, Mo.

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\*Porter Co., H. K., Pittsburgh, Pa.  
American Locomotive Co., New York, N. Y.  
Baldwin Locomotive Works, Philadelphia, Pa.  
Brookville Track & Tractor Co., Brookville, Pa.  
Burton Eng. & Mach. Co., Cincinnati, O.  
Davenport Locomotive Works, Davenport, Ia.  
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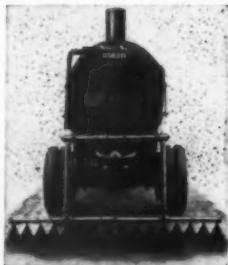
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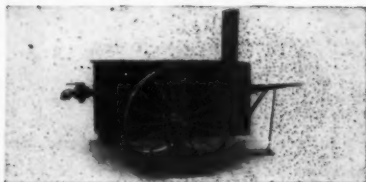
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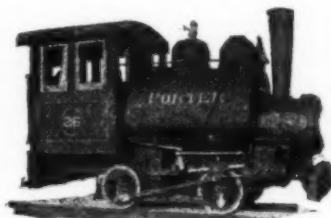
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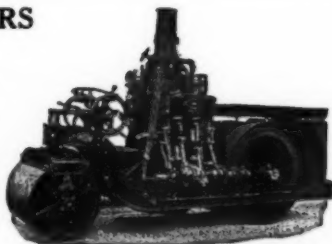
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Aurora Pump & Mfg. Co., Aurora, Ill.  
Buffalo Steam Pump Co., Buffalo, N. Y.  
Cameron Steam Pump Works, A. S., New York.  
Dayton-Dowd Co., Quincy, Ill.  
Dean Bros. Steam Pump Wks., Indianapolis, Ind.  
De Laval Steam Turbine Co., Trenton, N. J.  
Deming Co., Salem, O.  
Fairbanks, Morse & Co., Chicago, Ill.  
Gardner Governor Co., Quincy, Ill.  
Goulds Mfg. Co., Seneca Falls, N. Y.  
Indiana Air Pump Co., Indianapolis, Ind.  
Lea-Courtenay Co., Newark, N. J.  
Midwest Engine Co., Indianapolis, Ind.  
Morris Machine Works, Baldwinville, N. Y.  
Murray Iron Works Co., Burlington, Ia.  
Northern Fire Apparatus Co., Minneapolis, Minn.  
Scranton Pump Co., Scranton, Pa.  
Union Steam Pump Co., Battle Creek, Mich.  
Vogt Bros. Mfg. Co., Louisville, Ky.  
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Weinman Pump Mfg. Co., Columbus, O.  
Yeomans Bros. Co., Chicago, Ill.

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Aurora Pump & Mfg. Co., Aurora, Ill.  
Cameron Steam Pump Works, A. S., New York.  
Dayton-Dowd Co., Quincy, Ill.  
De Laval Steam Turbine Co., Trenton, N. J.  
Domestic Eng. & Pump Co., Shippensburg, Pa.  
Erie Pump & Engine Works, Medina, N. Y.  
Evinrude Motor Co., Milwaukee, Wis.  
Fairbanks, Morse & Co., Chicago, Ill.  
Goulds Mfg. Co., Seneca Falls, N. Y.  
Indiana Air Pump Co., Indianapolis, Ind.  
Lea-Courtenay Co., Newark, N. J.  
Manitowish Iron Wks., Manitowish, Mich.  
Midwest Engine Co., Indianapolis, Ind.  
Morris Machine Works, Baldwinville, N. Y.  
Schramm & Son, Inc., Chris. D., West Chester, Pa.  
United Iron Works, Kansas City, Mo.  
Wheeler Condenser & Eng. Co., Carteret, N. J.  
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Yeomans Bros. Co., Chicago, Ill.

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Aurora Pump & Mfg. Co., Aurora, Ill.  
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Cameron Steam Pump Works, A. S., New York.  
Carter Co., Ralph B., New York.  
Construction Mach'y Co., Waterloo, Ia.  
Dayton-Dowd Co., Quincy, Ill.  
Deming Co., Salem, Ohio.  
Domestic Engine & Pump Co., Shippensburg, Pa.  
Emerson Pump & Valve Co., Alexandria, Va.  
Erie Pump & Engine Works, Medina, N. Y.  
Evinrude Motor Co., Milwaukee, Wis.  
Fairbanks, Morse & Co., Chicago, Ill.  
Goulds Mfg. Co., Seneca Falls, N. Y.  
Lea-Courtenay Co., Newark, N. J.  
McGowan Co., J. R., Cincinnati, O.  
Midwest Engine Co., Indianapolis, Ind.  
Morris Machine Works, Baldwinville, N. Y.  
New York Eng. Co., New York.  
Northern Fire App. Co., Minneapolis, Minn.  
Novo Engine Co., Lansing, Mich.  
Pulsometer Steam Pump Co., New York.  
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Standard Scale & Supply Co., Pittsburgh, Pa.  
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Waldo Bros. & Bond Co., Boston, Mass.

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Cameron Steam Pump Works, A. S., New York.  
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Deming Co., Salem, O.  
Fairbanks, Morse & Co., Chicago, Ill.  
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Barnes Mfg. Co., Mansfield, O.  
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Lea-Courtenay Co., Newark, N. J.  
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Yeomans Bros. Co., Chicago, Ill.

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Light Ry. Equipment Co., Philadelphia, Pa.  
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Marion Steam Shovel Co., Marion, O.  
Osgood Co., Marion, O.  
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\*Buffalo Springfield Roller Co., Springfield, O.  
\*Good Roads Mach. Co., Kennett Square, Pa.  
\*Huber Mfg. Co., Marion, O.  
Avery Co., Peoria, Ill.  
Case Threshing Machine Co., J. I., Racine, Wis.  
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\*Buffalo Springfield Roller Co., Springfield, O.  
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\*Holt Mfg. Co., Peoria, Ill.  
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Avery Co., Peoria, Ill.

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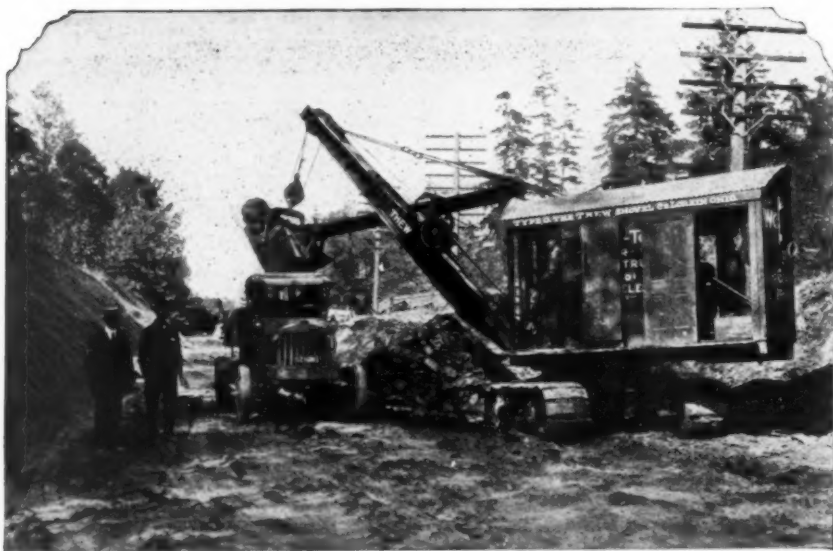
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 Eiler Mfg. Co., Canton, Ohio.  
 Milwaukee Corrugating Co., Milwaukee, Wis.  
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 Newport Rolling Mill Co., Newport, Ky.  
 Penn Metal Co., Boston, Mass.  
 Klauer Mfg. Co., Dubuque, Ia.  
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 Wheeling Metal Mfg. Co., Wheeling, W. Va.

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 Bucyrus Co., South Milwaukee, Wis.  
 Marion Steam Shovel Co., Marion, O.

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 \*Thew Shovel Co., Lorain, O.  
 American Steel Dredge Co., Fort Wayne, Ind.  
 Austin Machinery Corp'n, Chicago, Ill.  
 Fairbanks Steam Shovel Co., Marion, O.  
 Marion Steam Shovel Co., Marion, O.

**SHOVELS, HAND**  
 \*Pittsburgh Shovel Co., Pittsburgh, Pa.  
 American Shovel & Stamping Co., Lorain, O.  
 Ames Shovel & Tool Co., Boston, Mass.  
 Beall Bros. Co., Alton, Ill.  
 Chisholm Shovel Co., Cleveland, O.  
 Conneaut Shovel Co., Conneaut, O.  
 Hubbard & Co., Pittsburgh, Pa.  
 Indiana Shovel Co., New Castle, Ind.  
 Jackson Shovel Co., Montpelier, Ind.  
 Russell Shovel Co., Alliquippa, Pa.  
 Stevens-Webb Co., Inc., Altoona, Pa.  
 Union Furnace Mfg. Co., Altoona, Pa.  
 Wood Shovel & Tool Co., Piqua, Ohio.  
 Wyoming Shovel Works, Wyoming, Pa.

**SHOVELS, STEAM**  
 \*Keystone Driller Co., Beaver Falls, Pa.  
 \*Smith Co., T. L., Milwaukee, Wis.  
 \*Thew Shovel Co., Lorain, O.  
 American Steel Dredge Co., Fort Wayne, Ind.  
 Austin Machinery Corp'n, Chicago, Ill.  
 Fall Engine Co., Erie, Pa.  
 Bellwood Steam Shovel Co., Bellwood, Pa.  
 Browning Co., Cleveland, O.  
 Bucyrus Co., South Milwaukee, Wis.  
 Byers Machine Co., J. F., Ravenna, Ohio.  
 Erie Steam Shovel Co., Erie, Pa.  
 Fairbanks Steam Shovel Co., Marion, O.  
 Industrial Works, Bay City, Mich.  
 Marion Steam Shovel Co., Marion, O.  
 Osgood Co., Marion, O.

**SIGNS, STREET AND ROAD**  
 Baltimore Enamel & Novelty Co., Baltimore, Md.  
 Ingram-Richardson Mfg. Co., Beaver Falls, Pa.  
 Lyle-Signs, Minneapolis, Minn.  
 N. Y. Enamelled Steel Sign Co., New York.  
 Safety Equipment Service Co., Cleveland, O.  
 Thompson-Fleming Co., Inc., Buffalo, N. Y.  
 Union Iron Products Co., East Chicago, Ind.  
 Western Display & Mfg. Co., St. Paul, Minn.

**SIGNS, TRAFFIC**  
 Elkhart Fdry. & Mach. Co., Elkhart, Ind.  
 Esco Mfg. Co., Peoria, Ill.  
 Federal Signal Co., Albany, N. Y.  
 Ingram-Richardson Mfg. Co., Beaver Falls, Pa.  
 Little Giant Co., Mankato, Minn.  
 Lyle-Signs, Minneapolis, Minn.  
 Mound Traffic Equip. Co., Columbus, O.  
 Thompson-Fleming, Inc., Buffalo, N. Y.  
 Union Iron Products Co., E. Chicago, Ind.

**SLATE, ROOFING**  
 Vendor Slate Co., Inc., Easton, Pa.

**SLATE, STRUCTURAL**  
 Penna. Structural Slate Co., Easton, Pa.  
 Phenix Slate Co., Windgap, Pa.  
 Structural Slate Co., Pen Artyl, Pa.

**SLEEVES, TAPPING AND VALVE**  
 Mueller Mfg. Co., Decatur, Ill.  
 Rensselaer Valve Co., Troy, N. Y.  
 Smith Mfg. Co., A. F., East Orange, N. J.

**SLUICE GATES. (See Gates, Sluice.)**

**SMOKE STACKS. (See Stacks, Steel)**

**SNOW CLEANING MACHINERY**  
 \*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 \*Baker Mfg. Co., Springfield, Ill.  
 \*Cleveland Tractor Co., Cleveland, O.  
 \*Good Roads Mach. Co., Kennett Square, Pa.  
 \*Holt Mfg. Co., Peoria, Ill.  
 Avery Co., Peoria, Ill.  
 Barber-Greene Co., Aurora, Ill.  
 International Motor Co., New York.  
 Toy Co., W. M., Sidney, Ohio.  
 J. T. Tractor Co., Cleveland, O.  
 Owensboro Ditcher & Grader Co., Owensboro, Ky.

**SPRAYING MACHINERY**  
 Bean Spray Pump Co., Lansing, Mich.  
 Deming Co., The, Salem, Ohio.  
 Field Force Pump Co., Elmira, N. Y.  
 Fitzhenry-Guptill Co., Boston, Mass.

**SPREADERS, STONE**  
 \*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 \*Burch Flow Works Co., Crestline, O.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.



For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

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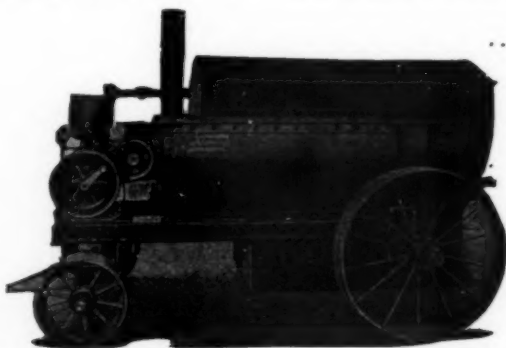


## HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated.

No Steam Required.



## Kinney Manufacturing Company

3529 Washington Street  
BOSTON, MASSACHUSETTS

### BRANCHES:

NEW YORK

PHILADELPHIA

CHICAGO  
SAN FRANCISCO

HOUSTON

KANSAS CITY

## STACKS, STEEL

- \*Connery & Co., Inc., Philadelphia, Pa.
- \*Heil Co., The, Milwaukee, Wis.
- \*Littleford Bros., Cincinnati, O.
- Blaw-Knox Co., Pittsburgh, Pa.
- Chatta. Boiler & Tank Co., Chattanooga, Tenn.
- Chicago Bridge & Iron Works, Chicago, Ill.
- Honhorst Co., Jos., Cincinnati, O.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
- Walsh & Weldner Boiler Co., Chattanooga, Tenn.

## STEAM SHOVELS. (See Shovels, Steam)

## STANDPIPES, TANKS AND TOWERS

- \*Connery & Co., Inc., Philadelphia, Pa.
- Caldwell Co., W. E., Louisville, Ky.
- Chattanooga B'r. & Tank Co., Chattanooga, Tenn.
- Chicago Bridge & Iron Works, Chicago, Ill.
- Lancaster Iron Wks., Lancaster, Pa.
- Pacific Tank & Pipe Co., San Francisco, Cal.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- United Iron Works, Kansas City, Mo.
- Walsh & Weldner Boiler Co., Chattanooga, Tenn.

## STEAM TURBINES

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- De Laval Steam Turbine Co., Trenton, N. J.
- Ingersoll-Rand Co., New York.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## STEEL PLATE CONSTRUCTION

- \*Connery & Co., Philadelphia, Pa.
- \*Heil Co., The, Milwaukee, Wis.
- \*Littleford Bros., Cincinnati, O.
- Bethlehem Steel Bridge Co., Bethlehem, Pa.
- Biggs Boiler Wks., Akron, O.
- Birmingham Steel Corp., Birmingham, Ala.
- Blaw-Knox Co., Pittsburgh, Pa.
- Chatta. Boiler & Tank Co., Chattanooga, Tenn.
- Chicago Bridge & Iron Works, Chicago, Ill.
- Heltzel Steel Form & Iron Co., Warren, O.
- Hendrick Mfg. Co., Carbondale, Pa.
- Honhorst Co., Jos., Cincinnati, Ohio.
- McClintic-Marshall Co., Pittsburgh, Pa.
- Pennsylvania Bridge Co., Beaver Falls, Pa.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- Ritter-Conley Co., Pittsburgh, Pa.
- Scaife & Sons, Wm. B., Pittsburgh, Pa.
- Toledo Crane Co., Toledo, O.
- Union Iron Works, Hoboken, N. J.
- Vulcan Iron Works, Jersey City, N. J.
- Walsh & Weldner Boiler Co., Chattanooga, Tenn.

## STOKERS, MECHANICAL

- Automatic Furnace Co., Dayton, Ohio.
- Babcock & Wilcox Co., N. Y. C.
- Detroit Stoker Co., Detroit, Mich.
- Laclede-Christy Clay Prod. Co., St. Louis, Mo.
- Murphy Iron Works, Detroit, Mich.
- Sanford Riley Stoker Co., Worcester, Mass.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## STREET AND ROAD SIGNS. (See Signs, Street and Road.)

## STREET CLEANERS' CARTS

- \*Rochester Can Co., Rochester, N. Y.
- Durlach Can & Iron Works, Brooklyn, N. Y.
- Tarrant Mfg. Co., Saratoga Springs, N. Y.

## STREET FLUSHERS AND SPRINKLERS

- \*Austin-Western Road Machy. Co., Chicago, Ill.
- \*Autocar Co., Ardmore, Pa.
- \*General Motors Truck Co., Pontiac, Mich.
- \*Municipal Supply Co., South Bend, Ind.
- Etnyre & Co., E. D., Oregon, Ill.
- Federal Motor Truck Co., Detroit, Mich.
- Four Wheel Drive Auto Co., Clintonville, Wis.
- International Motor Co., New York.
- Packard Motor Car Co., Detroit, Mich.
- Pierce Arrow Motor Car Co., Buffalo, N. Y.
- Service Motor Truck Co., Wabash, Ind.
- Tiffin Wagon Co., Tiffin, O.
- White Co., Cleveland, O.

## STREET LAMP POSTS

- Clow & Sons, J. B., Chicago, Ill.
- Drake Mfg. Co., Friendship, N. Y.
- Electric Railway Equipment Co., Cincinnati, O.
- General Electric Co., Schenectady, N. Y.
- King Mfg. Co., Chicago, Ill.
- Massey Concrete Products Co., Chicago, Ill.
- Union Metal Mfg. Co., Canton, O.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## STREET SIGNS. (See Signs, Street)

## STREET SWEEPERS

- \*Austin-Western Road Machy. Co., Chicago, Ill.
- \*Good Roads Mach. Co., Kennett Square, Pa.

Elgin Sales Corp'n, New York.

Tiffin Wagon Co., Tiffin, O.

Universal Road Machy. Co., Kingston, N. Y.

## STRUCTURAL STEEL AND IRON. (See Bridges and Buildings)

## STUMP PULLERS

- Bennett & Co., H. L., Westerville, O.
- Clyde Iron Works, Duluth, Minn.
- Lewis & Valentine, Reasly, L. I.
- Thomas Elevator Co., Chicago, Ill.

## SURVEYORS' INSTRUMENTS. (See Instruments.)

## SWITCHBOARDS

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- General Electric Co., Schenectady, N. Y.
- Wagner Elec. Mfg. Co., St. Louis, Mo.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## SWITCHES AND FROGS

- \*Koppel Ind. Car & Equip. Co., Koppel, Pa.
- Light Ry. Equip. Co., Philadelphia, Pa.

## TABLES AND BOARDS, DRAWING. (See Drawing Materials.)

## TAMPING MACHINES

- \*Pawling & Harnsfeffer Co., Milwaukee, Wis.
- Construction Mach'y Co., Waterloo, Ia.
- Ingersoll-Rand Co., New York

## TANKS, AIR COMPRESSOR

- \*Connery & Co., Inc., Philadelphia, Pa.
- \*Heil Co., Milwaukee, Wis.
- \*Littleford Bros., Cincinnati, O.
- Abendroth & Root Mfg. Co., New York.
- Biggs Boiler Wks., Akron, O.
- Indiana Air Pump Co., Indianapolis, Ind.
- Chicago Bridge & Iron Works, Chicago, Ill.
- Ingersoll-Rand Co., New York.
- Lancaster Iron Wks., Lancaster, Pa.
- National Tube Co., Pittsburgh, Pa.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- Scaife & Sons Co., W. B., Pittsburgh, Pa.
- Westinghouse Tract. Erake Co., Wilmerding, Pa.
- Worthington Pump & Machy. Corp., New York

## TANKS FOR OIL

- \*Connery & Co., Philadelphia, Pa.
- \*Heil Co., Milwaukee, Wis.
- \*Littleford Bros., Cincinnati, O.
- Biggs Boiler Works Co., Akron, O.
- Bowser & Co., Inc., S. F., Fort Wayne, Ind.
- Chatta. Boiler & Tank Co., Chattanooga, Tenn.
- Chicago Bridge & Iron Works, Chicago, Ill.
- Dover Boiler Works, New York.
- Fouts Co., C. C., Middletown, O.
- Honhorst Co., Jos., Cincinnati, Ohio.
- Pacific Tank & Pipe Co., San Francisco, Cal.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- Ritter-Conley Co., Pittsburgh, Pa.
- Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
- United Iron Works, Kansas City, Mo.
- Walsh & Weldner Boiler Co., Chattanooga, Tenn.
- Wayne Tank & Pump Co., Ft. Wayne, Ind.

## TANKS, STEEL

- \*Connery & Co., Philadelphia, Pa.
- \*Heil Co., Milwaukee, Wis.
- \*Littleford Bros., Cincinnati, O.
- Avery Co., Peoria, Ill.
- Biggs Boiler Wks., Akron, O.
- Case Threshing Mach. Co., J. I., Racine, Wis.
- Caldwell Co., W. E., Louisville, Ky.
- Chatta. Boiler & Tank Co., Chattanooga, Tenn.
- Chicago Bridge & Iron Works, Chicago, Ill.
- Columbian Steel Tank Co., Kansas City, Mo.
- Hardesty Mfg. Co., R., Denver, Col.
- Hendrick Mfg. Co., Carbondale, Pa.
- Honhorst Co., Jos., Cincinnati, Ohio.
- Lancaster Iron Works, Lancaster, Pa.
- Milwaukee Corrugating Co., Milwaukee, Wis.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- Scaife & Sons, Wm. B., Oakmont, Pa.

## TANKS, WOOD

- Caldwell Co., W. E., Louisville, Ky.
- Davis & Son, G. M., Palatka, Fla.
- Eagle Tank Co., Chicago, Ill.
- Hauer-Stander Tank Co., Cincinnati, O.
- Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
- National Tank & Pipe Co., Portland, Ore.
- Pacific Tank & Pipe Co., San Francisco, Cal.
- Redwood Manufacturers Co., San Francisco, Calif.
- Stearns Lumber Co., A. T., Boston, Mass.
- U. S. Wind Engine & Pump Co., Batavia, Ill.
- Wendnazel & Co., Chicago, Ill.

## TANK WAGONS

- \*Acme Road Mach. Co., Frankfort, N. Y.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.





### Tractor Power that Pays

Best Tractors have won many a closely figured contract and have turned many a losing job into a profitable undertaking—simply because of their absolute worth, power and dependability. Let us send you information on how Bests handle the hard jobs requiring heavy duty, reliable power. Write today for catalog and folders describing jobs Best Tractors have handled.

#### C. L. BEST TRACTOR CO.

Factory and General Office, San Leandro, Cal.  
Distributing Warehouses, Spokane, Wash., St. Louis, Mo.

## BEST TRACTORS



Part of Fleet  
of 53 Trucks  
all equipped  
by Heil

Timothy Motor Trucking Co.  
Chicago, Ill.

## FLEET INSTALLATIONS

of Heil Dump Bodies and Hydro Hoists

"Heil Equipment has given me excellent success"—"surpass anything we have used to date"—"if we don't talk about them we forget we have them", etc. Boosters like these are found wherever Heil Equipment is used. Send for our new portfolio on "Road Building Equipment". It will help you select the proper kind of dumping equipment for your work. Write today.

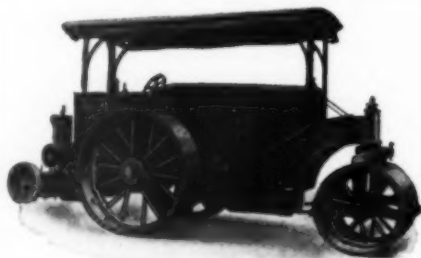
### THE HEIL CO.

1243-26th Ave.

Milwaukee, Wisconsin



Kores Contracting Co., Saint Paul, Minn.



## ONE MORE ACME TRIUMPH The FOUR-CYLINDER MOTOR ROAD ROLLER WITH AN AIR PRESSURE CONTROLLED SCARIFIER

### ACME ROAD MACHINERY CO.

Factory—FRANKFORT, N. Y.

BRANCHES: { Boston, Mass. Baltimore, Md. Chicago, Ill.  
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10 Gallon Capacity

## CONNERYS' Tar and Asphalt Heaters

Non-Leakable Welded—"Held by the Weld." 20 Styles.

10 to 1000 Gallon Capacity Carried in Stock.

This kettle (10-gallon capacity) is ideal for road contractors and is especially made for small patch work where there are a considerable number of small holes to be properly filled up with gravel or crushed stone and cemented with bituminous binder. The inside pot lifts out and can readily be used as a pouring pot.

Send your name for illustrated material on all sizes and styles.

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Case Threshing Mach. Co., J. I., Racine, Wis.  
International Motor Co., New York.
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Dietgen Co., Engene, New York.  
Kuefel & Esser Co., Hoboken, N. J.  
Lufkin Rule Co., Saginaw, Mich.  
Starrett, L. S., Athol, Mass.
- TAPPING MACHINES**  
Hays Mfg. Co., Erie, Pa.  
Mueller Mfg. Co., H., Decatur, Ill.  
Smith Mfg. Co., A. P., E. Orange, N. J.
- TAB**  
Barrett Co., New York.
- TAB KETTLES. (See Kettles)**
- TIES, STEEL**  
Carnegie Steel Co., Pittsburgh, Pa.  
Light Ry. Equip. Co., Philadelphia, Pa.  
Koppel Ind. Car & Equip. Co., Koppel, Pa.  
Sweet's Steel Co., Williamsport, Pa.
- TIRES, RUBBER. (For Motor Trucks.)**  
Firestone Tire & Rubber Co., Akron, O.  
Goodrich Rubber Co., B. F., Akron, O.  
Goodyear Tire & Rubber Co., Akron, O.  
Kelly Springfield Tire Co., New York.  
Republic Rubber Co., Youngstown, O.  
U. S. Tire Co., New York.
- TOOL HOUSES, PORTABLE STEEL**  
\*Littleford Bros., Cincinnati, O.
- TOWERS (See Standpipe Tanks and Towers)**
- TRACKS, INDUSTRIAL AND PORTABLE**  
Chase Fdry. & Mfg. Co., Columbus, O.  
Easton Car & Constr. Co., New York.  
Hunt Co., Ind. C. W., West New Brighton, N. Y.  
Koppel Ind. Car & Equip. Co., Koppel, Pa.  
Lakewood Engineering Co., Cleveland, O.  
Light Ry. Equipment Co., Philadelphia, Pa.
- TRACTORS**  
\*Best Tractor Co., C. L., San Leandro, Cal.  
\*Cleveland Tractor Co., Cleveland, O.  
\*Holt Mfg. Co., Peoria, Ill.  
\*Huber Mfg. Co., Marion, O.  
\*Little Giant Co., Mankato, Minn.  
Advance-Rumely Thresher Co., Laporte, Ind.  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Avery Co., Peoria, Ill.  
Barrett-Cravens Co., Chicago, Ill.  
Bates Machine & Tractor Co., Joliet, Ill.  
Case Threshing Machine Co., J. I., Racine, Wis.  
Clark Tractor Co., Chicago, Ill.  
Dart Truck & Tractor Corp., Waterloo, Ia.  
Dayton-Dowd Co., Quincy, Ill.  
Fairbanks, Morse & Co., Chicago, Ill.  
Four Wheel Drive Auto Co., Clintonville, Wis.  
Hart-Parr Co., Charles City, Iowa.  
International Motor Co., New York.  
J. T. Tractor Co., Cleveland, O.  
Oliver Tractor Co., Knoxville, Tenn.  
Selden Truck Corp'n., Co., Wabash, Ind.  
Service Motor Truck Co., Wabash, Ind.  
Twin City Co., Minneapolis, Minn.  
Watson Products Corp., Canastota, N. Y.  
White Company, The, Cleveland, O.
- TRAFFIC PAINT**  
Hoosier Paint Wks., Ft. Wayne, Ind.  
Tropical Paint & Oil Co., Cleveland, Ohio.
- TRAFFIC SIGNS. (See "Signs, Traffic")**
- TRAILERS FOR TRUCKS AND TRACTORS**  
Arcadia Trailer Corp., Newark, N. Y.  
Eagle Wagon Works, Auburn, N. Y.  
Highway Trailer Co., Edgerton, Wis.  
Lee Trailer & Body Co., Chicago, Ill.  
Troy Wagon Works, Troy, O.  
Warner Mfg. Co., Beloit, Wis.  
Watson Products Corp'n., Canastota, N. Y.
- TRAILERS, INDUSTRIAL**  
Chase Fdry. & Mfg. Co., Columbus, O.  
Electric Wheel Co., Quincy, Ill.  
Lakewood Engineering Co., Cleveland, O.  
Lee Trailer & Body Co., Chicago, Ill.
- TRAMWAYS, AERIAL WIRE ROPE**  
Broderick & Bascom Rope Co., St. Louis, Mo.  
Loachen & Sons Rope Co., A., St. Louis, Mo.
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General Electric Co., Schenectady, N. Y.  
Kuhlman Electric Co., Bay City, Mich.  
Westinghouse Elec. & Mfg. Co., E. Pitts'gh, Pa.
- TRANSITS AND LEVELS. (See Instruments.)**
- TRANSMISSION MACHINERY, POWER**  
\*Weller Mfg. Co., Chicago, Ill.
- Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Chain Belt Co., Milwaukee, Wis.  
Dodge Mfg. Co., Mishawaka, Ind.  
General Electric Co., Schenectady, N. Y.  
Link-Belt Co., Chicago, Ill.  
Webster Mfg. Co., Chicago, Ill.
- TRASH CANS. (See Cans)**
- TREADS, SAFETY**  
American Abrasive Metals Co., New York.  
American Mason Safety Tread Co., Lowell, Mass.  
Concrete Steel Co., New York.  
Hendrick Mfg. Co., Carbondale, Pa.  
Norton Co., Worcester, Mass.
- TRENCH BRACES. (See Braces, Trench)**
- TRENCH EXCAVATORS. (see Excavators, Ditch & Trench)**
- TRENCH PUMPS. (See Pumps, Contractors')**
- TURBINES**  
Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
De Laval Steam Turbine Co., Trenton, N. J.  
General Electric Co., Schenectady, N. Y.  
Ingersoll-Rand Co., New York.  
Midwest Engine Co., Indianapolis, Ind.  
Westinghouse Elec. & Mfg. Co., E. Pitts'gh, Pa.
- TURNABLES FOR MOTOR TRUCKS**  
Bickel Contracting Co., Kansas City, Mo.  
Blaw-Knox Co., Pittsburgh, Pa.  
Champion Eng. Co., Kenton, O.  
Hug Co., Highland, Ill.  
Western Structural Co., Moline, Ill.
- USED MACHINERY**  
(See Contractors' Used Equipment.)
- VALVE CONTROL APPARATUS, ELECTRIC**  
Payne Dean, Ltd., New York.
- VALVES, GATE AND INDICATOR POSTS**  
\*Ludlow Valve Mfg. Co., Troy, N. Y.  
Chapman Valve Mfg. Co., Indian Orchard, Mass.  
Crane Company, Chicago, Ill.  
Darling Valve & Mfg. Co., Williamsport, Pa.  
Eddy Valve Co., Watford, N. Y.  
Fairbanks Co., The, New York.  
Iowa Valve Co., Oskaloosa, Ia.  
Kennedy Valve Mfg. Co., Elmira, N. Y.  
Lunkensheimer Co., Cincinnati, O.  
Pratt & Cady Co., Inc., Hartford, Conn.  
Reading Steel Casting Co., Inc., Bridgeport, Conn.  
Rensselaer Valve Co., Troy, N. Y.  
Smith Mfg. Co., A. P., East Orange, N. J.  
Wood & Co., R. D., Philadelphia, Pa.
- VALVE BOXES AND HOUSINGS**  
\*Central Foundry Co., New York.  
\*Clark Co., H. W., Mattison, Ill.  
\*Ludlow Valve Co., Troy, N. Y.  
\*D. S. C. R. Pipe & Fdry. Co., Burlington, N. J.  
Chapman Valve Mfg. Co., Indian Orchard, Mass.  
Clow & Sons, J. B., Chicago, Ill.  
Columbian Iron Works, Chattanooga, Tenn.  
Darling Valve & Mfg. Co., Williamsport, Pa.  
Eddy Valve Co., Watford, N. Y.  
Fairbanks Co., The, New York.  
Iowa Valve Co., Oskaloosa, Ia.  
Kennedy Valve Mfg. Co., Elmira, N. Y.  
Mueller Mfg. Co., H., Decatur, Ill.  
Pratt & Cady Co., Inc., Hartford, Conn.  
Rensselaer Valve Co., Troy, N. Y.  
Smith Mfg. Co., A. P., East Orange, N. J.  
S. E. T. Valve & Hydrant Co., New York.  
Wood & Co., R. D., Philadelphia, Pa.
- VENTILATORS**  
American Blower Co., Detroit, Mich.  
Edwards Mfg. Co., Cincinnati, O.  
Milwaukee Corrugating Co., Milwaukee, Wis.
- WAGONS. (See Dump Carts and Wagons.)**
- WAGON BODIES. (See Dump Bodies)**
- WAGON LOADERS. (See Loaders, Gravel and Wagon)**
- WALLBOARD**  
\*Carvy Co., Philip, Cincinnati, Ohio.  
Beaver Board Companies, Buffalo, N. Y.  
Bird & Son, Inc., E. Walpole, Mass.  
Cornell Wood Products Co., Chicago, Ill.  
Haverhill Box Board Co., Haverhill, Mass.  
MacAndrews & Forbes Co., New York, N. Y.  
Plastergton Wall Board Co., Buffalo, N. Y.  
United States Gypsum Co., Chicago, Ill.  
Upson Co., The, Lockport, N. Y.  
Waldorf Paper Products Co., St. Paul, Minn.
- WALL TIES**  
Concrete Steel Co., New York, N. Y.  
Consolidated Expanded Metal Co., Braddock, Pa.  
Berger Mfg. Co., Canton, O.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

Milwaukee Corrugating Co., Milwaukee, Wis.  
Niagara Metal Stamp Corp., Niagara Falls, N. Y.

#### WATER MAIN CLEANING

\*National Water Main Cleaning Co., New York.

#### WATER MAIN TAPPING MACHINES

Mueller Mfg. Co., H., Decatur, Ill.

Smith Mfg. Co., A. F., East Orange, N. J.

#### WATER METERS. (See Meters, Water.)

#### WATERPROOFING COMPOUNDS AND MATERIAL

\*Barber Asphalt Co., Philadelphia, Pa.

\*Carey Company, Philip, Cincinnati, O.

\*Standard Oil Co. (Indiana), Chicago, Ill.

\*Texas Company, New York.

Anti-Hydro Waterproofing Co., Newark, N. J.

Atlantic Refining & Asphalt Corp., Phil'a, Pa.

Barrett Company, New York.

General Fireproofing Co., Youngstown, O.

Granitex Corp., New York.

Horn Co., A. C., Long Island City, N. Y.

Master Builders' Co., Cleveland, O.

Minwax Co., The, New York.

Protexol Corp., New York.

Ruberoid Co., New York.

Sonneborn Sons, Inc., New York.

Tuck Brothers, New York

Truscon Laboratories, Detroit, Mich.

#### WATER PURIFICATION

\*Wallace & Tiernan Co., Inc., Newark, N. J.

Clow & Sons, J. B., Chicago, Ill.

Electro Bleaching Gas Co., New York.

N. Y. Continental Jewell Filter Co., Nutley, N. J.

Mathieson Alkali Works, Inc., New York.

Norwood Eng. Co., Florence, Mass.

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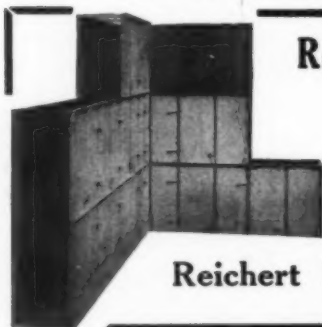
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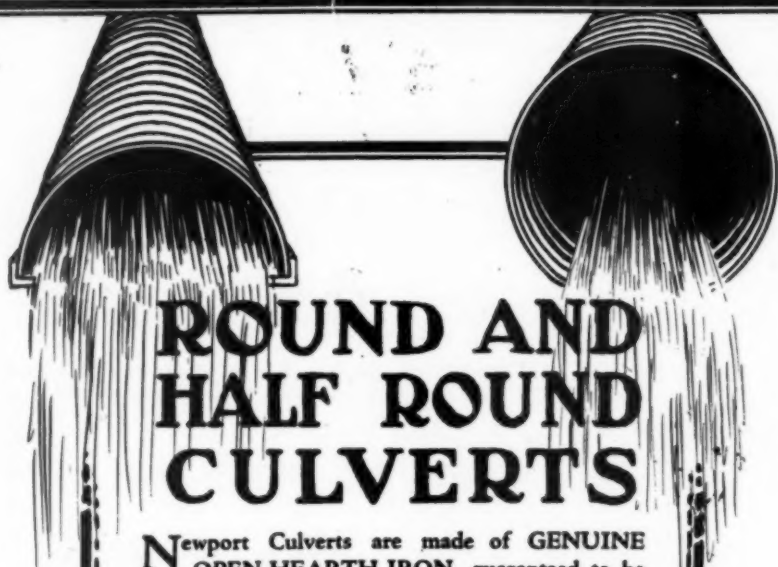
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# CONTRACTORS' & ENGINEERS' MONTHLY

A PURCHASING GUIDE FOR ENGINEERS, CONTRACTORS, PUBLIC OFFICIALS AND OTHER PURCHASERS  
OF CONSTRUCTION MATERIALS AND EQUIPMENT

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CONTENTS FOR AUGUST, 1922

No. 2

	PAGE
Constructing the New Covered Reservoir at Perth Amboy, N. J.....	43
Prospects for Building Construction in American Cities.....	46
Legal Points for Contractors.....	47
Underpinning with and without Compressed Air.....	49
Bucyrus Enlarges Plant.....	52
Bituminous Road Treatment Materials and Apparatus.....	53
Cletrac Makers Expand.....	55
A Hydraulic Ash Hoist.....	56
New President of A. R. B. A.....	56
The Advantages of Nestable Culverts.....	57
Loading Trucks at 2 Cubic Yards per Minute.....	58
A Ladder Safety Code.....	58
Associated General Contractors—News Notes and Comments.....	59
Materials, the Fuel of Construction.....	59
Handy Catalogs Help Contractors.....	61
A New Shovel Dipper to Increase Yardage.....	63
Street Machine Repairs in Winter.....	63
Equipment Used by Live Contractors.....	64
A Continuous Roofing Kettle.....	66
Miscellaneous Notes.....	66
Chuting Concrete on Small Jobs.....	67
High Speed Brush for Cleaning Metal Work.....	68
A Universal Dump Body for One-Ton Trucks.....	68
Stone Production in Davidson County, Tenn.....	70
A Midget Tar and Asphalt Heater.....	72
A New and Larger Motor for Excavator and Loader.....	72

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# Contractors' & Engineers' Monthly

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Vol. V, No. 2

New York

August, 1922

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## Constructing the New Covered Reservoir at Perth Amboy, New Jersey

By Alexander Johnson

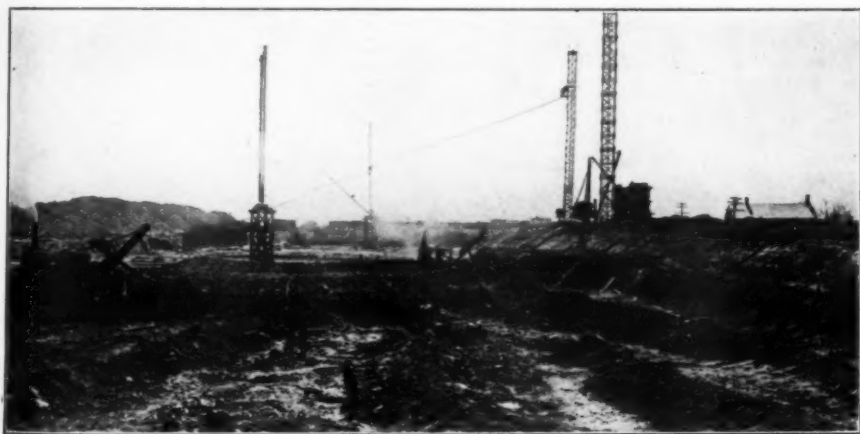
Frederick Snare Corporation, New York City

THE form and design of a forty-million-gallon unit of a water-distributing reservoir recently completed for the city of Perth Amboy, N. J., were made by George A. Johnson, who, as consulting engineer to the city, had investigated Perth Amboy's water-supply problem. As a result of his investigation, Mr. Johnson devised a comprehensive plan of developing an additional and adequate supply of water to meet the community's need for some time to come. This plan, in its realization, involves construction in several successive steps, to be timed with certain stages of water consumption by the community.

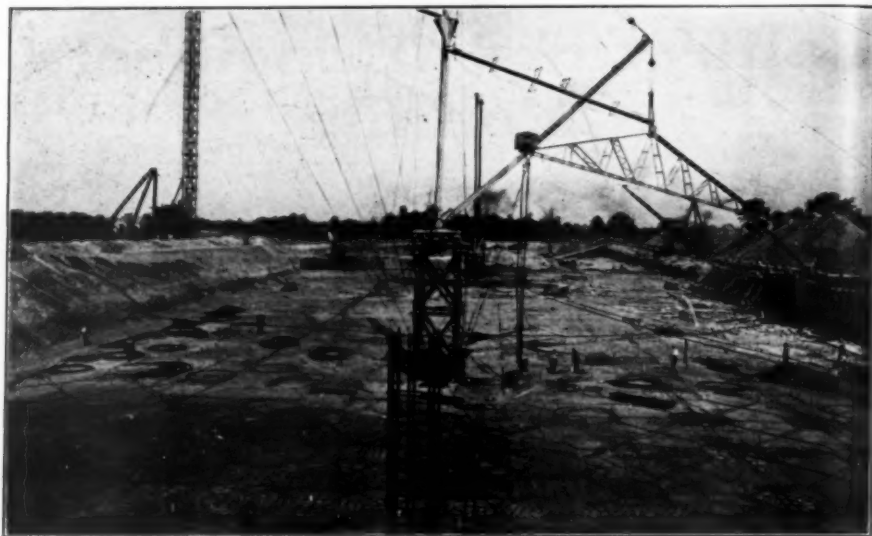
The first construction determined upon was that of a storage and distributing reservoir located on high ground near the northwesterly limits of the city. The ultimate required capacity of the reservoir was estimated at 160,000,-

000 gallons, but on the basis of present water consumption it was decided to limit immediate construction to one unit of such a reservoir, sufficient for the storage of forty million gallons of water. Designs for this unit were prepared by Mr. Johnson, and in April, 1920, following the receipt by the city of competitive bids, the contract for its construction was awarded to The Snare and Triest Company (now Frederick Snare Corporation) of New York, the lowest bidder, at the price of \$1,095,566.

The unit which has been built is 900 feet long at full water-level, with width varying from 230 feet to 370 feet and a water depth of 25 feet. The variation in width is caused by following the line of the public highway bounding one side of the reservoir. Three sides of the reservoir are of compacted clay embankment



EXCAVATION 75 PER CENT COMPLETE FOR THE FIRST UNIT OF THE NEW PERTH AMBOY 160,000,000-GALLON WATER DISTRIBUTING RESERVOIR



**EXCAVATION ABOUT 90 PER CENT COMPLETE—RESERVOIR FLOOR WITH PORTION OF REINFORCING IN PLACE READY FOR POURING CONCRETE**

surmounted by reinforced concrete retaining walls 7 feet high, and the fourth side is a reinforced concrete wall slightly over 25 feet in height, which later will serve as a dividing wall between this unit and subsequent units. The roof and floor are flat-slab reinforced concrete construction, the roof being carried on reinforced concrete columns. The embankment-slopes within the reservoir are lined with plain concrete. The roof slab is covered with earth to a depth of  $2\frac{1}{4}$  feet. Air vents built into the roof project through the earth cover, and vitrified pipe underdrains are laid in the earth cover.

The work embraced under the contract included stripping 10,000 cubic yards of top soil, excavation of approximately 90,000 cubic yards of earth, mostly clay, construction of 40,000 cubic yards of compacted clay embankments, placing 2,000,000 pounds of steel, pouring 21,000 cubic yards of concrete, depositing 40,000 cubic yards of earth and top soil on the roof slab and outer slopes of embankments, and grading city property immediately adjacent to the reservoir. Included also in the contract were the furnishing and laying of cast iron pipe varying from 6 inches to 30 inches in diameter, for approximately 3 miles of street mains.

Top soil was stripped, using a Keystone grader equipped with a half-yard bucket. The soil was loaded by the grader into horse-drawn dump-trucks, which hauled it to storage piles along one side.

To one side of the reservoir site the ground sloped gently downward from the floor level. In excavating, the first cut with the steam shovel was made on this side. A box drain was laid

from this cut through the ground sloping away from the reservoir, and as the excavation on this side was always kept a little below the rest, the drainage of the entire basin area was toward this point. This lessened to a considerable extent the difficulty in steam shovel operation over a clayey bottom after heavy rainfalls.

After the top soil had been removed, excavation of earth proceeded, three steam shovels of the revolving type equipped with three quarter-yard buckets being in use. The total depth to be excavated averaged about 10 feet, and this excavation was made in two cuts of 5 feet each. The first cut made was loaded by the shovels into dump-trucks and deposited in rolled embankments for the walls.

Embankments were built in layers evenly spread to a thickness of 6 inches before being compacted, and their tops were kept approximately level so as to avoid as much as possible erosion due to rain. Each layer deposited in the embankment was compacted by a heavy steam roller. In places where it was not possible to pass the roller, the earth was spread in layers 4 inches thick and compacted by hand ramming.

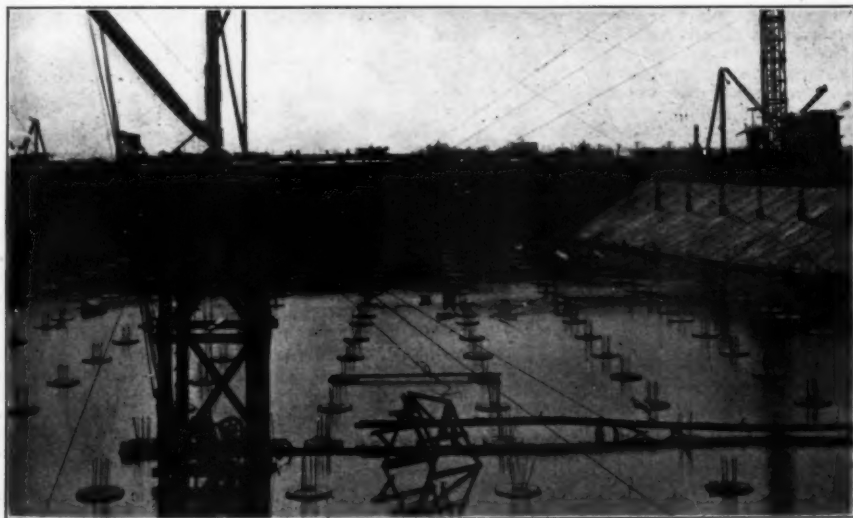
In making the second cut of 5 feet, the steam shovels loaded the earth into scale boxes placed on four-wheel flat cars operating over 36-inch-gage double track laid on the bottom level. This double track extended from the shovel location to the partition wall side of the basin. On the bank along this side and back of the line of wall was operated a traveling stiff-leg derrick equipped with a 70-foot boom. The scale boxes were transported between shovel and derrick in two car trains, hauled by dinkies, and passing each other over the double track. The

loaded scale boxes were hoisted from the cars by the derrick, dumped outside in a storage pile extending along the line of the wall and then returned empty to the cars below. The earth taken from this second cut was stored for use in the earth cover over the roof slab and for grading. The top soil previously removed has also been stored on this side of the reservoir within reach of the traveling derrick.

The construction of the concrete masonry followed the excavation and placing of embankments. The walls were first poured, then the column pedestals, floor slab, columns and roof slab. Deformed steel bars were used for reinforcement of the walls, and the columns were reinforced with round bars and hoops. In the floor and roof slabs the Smulski system of reinforcement, consisting of a combination of rings and radials, was used. There are three expansion joints separating the floor and roof into four parts of about equal lengths. The panels are 18.5 feet square, except at the wall, where the span is shortened to about 16 feet. The roof slab is freely supported at the wall. Wooden forms were used for the walls, and steel forms for the columns. The roof forms were also of wood and were constructed in sections 25 feet high and 18.5 feet square, the side panels and heads being hinged in order to pass the form between columns when moving ahead. Before pouring the slab, the form was wedged to position, and when ready to move ahead, the wedges were drawn and the section advanced by means of timber dollies under each corner. As many as twenty of these forms were moved ahead in one day by eight men. All bending of reinforcement bars was done at the reservoir site. For the rings a power bender was used.

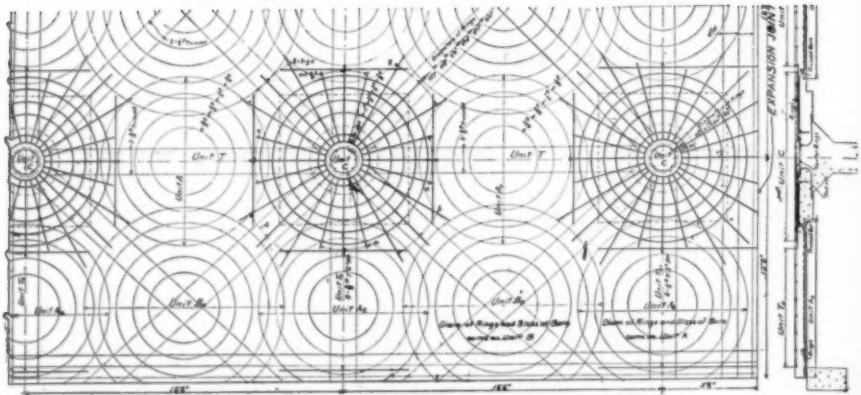
The plant used in concreting was assembled at two timber towers, each 180 feet high, located on the bank opposite the dividing wall. One of these towers was shifted to a second position, so that virtually three towers in one line and spaced about 250 feet apart were used. The mixed concrete was delivered through chutes extending across the basin from the tower and supported midway by a guy derrick. At the foot of each tower was a 1-yard Lakewood mixer, steam-operated, fed by a bin having a capacity of 100 cubic yards of gravel and 50 cubic yards of sand. A stiff-leg derrick with 75-foot boom and  $\frac{3}{4}$ -yard clam-shell served the bin with aggregate, this being taken from storage piles within reach of the derrick. Near each tower was a cement shed of 8,000-bag capacity. Cement was delivered over an incline built from shed to mixer by a car operating on industrial track. The power required for hauling this car was supplied by the engine operating the mixer.

As sections of roof slab were completed, depositing earth cover and backfilling against the walls proceeded. As before stated, all the excavated earth stored for this purpose was piled outside the line of the dividing wall within reach of a traveling derrick which had been used to dispose of materials coming from the steam shovels. A traveling hopper was set up on the edge of the roof nearest this derrick, and the earth required for cover and backfill, as well as the top soil, was loaded through this hopper into dump-trucks and deposited by them over the roof and at the walls, a 2-yard clam-shell bucket being used in conjunction with the derrick in this operation. Top soil was spread over the earth cover and on the outer slopes of



VIEW OF RESERVOIR FLOOR COMPLETED, WITH REINFORCING RODS PROJECTING FOR BONDING WITH COLUMNS—FIRST SECTION OF FORMS READY FOR ROOF





CONTRACT PLAN OF REINFORCING FOR RESERVOIR FLOOR, SHOWING VARIOUS UNITS

embankments and then sowed with grass seed. The entire work was completed within the period of time specified in the contract, and the reservoir was placed in service on July 4, 1921. George A. Johnson, the consulting engineer

who designed the reservoir, and Morgan F. Larson, City Engineer, supervised the work for the city of Perth Amboy. B. F. Robinson directed the work as superintendent for Fredrick Snare Corporation.

## Prospects for Building Construction in American Cities

**L** EONARD P. AYRES, Vice-President of the Cleveland Trust Company, Cleveland, Ohio, has made an extensive study of building construction before the war and since the war and the prospects of increased construction in various American cities in the next few years. As a result of this intensive study, a 35-page booklet has been published which contains a great deal of material of value and interest to the building contractor. The following paragraphs summarize the findings:

"1. Since the outbreak of the war in 1914 a great shortage of building construction has been accumulating in this country.

"2. A study has been made of the value of building permits in 50 large cities from 1900 through 1921, and by extending the general trend of the pre-war expenditures an attempt has been made to estimate what the volume of new construction would probably have been if the war had not occurred.

"3. The difference between the new construction actually undertaken in the six years from 1916 through 1921, and the amount that probably would have been begun if the war had not intervened, is so great that it is equal to 2.44 times the estimated normal construction for 1921.

"4. The existing building shortage in these 50 cities is so great that building could continue at about 25 per cent above its normal activity for ten years before it would entirely make up the deficit.

"5. To make up the indicated deficit in these 50 cities would apparently require about 1,256,000 building operations, of which 703,000 would call for the erection of new structures, and the remaining 553,000 for additions, alterations, etc.

"6. Of the 703,000 new buildings, about 303,000 would be residential, and the remaining 400,000 would be buildings of other sorts, of which a large majority would be garages. The 303,000 residential buildings would be largely one-family houses, but a sufficient number of them would shelter more than one family to furnish accommodations in all for about 424,000 families.

"7. Since these 50 cities include in their populations nearly one-fourth of all the people in the country, the figures that have been given may be multiplied by four to give a rough, although probably high, estimate of the building shortage in the entire country.

"8. Figures showing the annual course of the cost of building since 1840 indicate that the relative increase and succeeding drop in building costs at the time of the Civil War were similar to the corresponding price movements during and after the World War, but the latter were somewhat more violent.

"9. There is a great range in the average annual per capita expenditure for new buildings in these 50 cities. The lowest figure is \$12.07 for Fall River, the highest, \$64.31, is Los Angeles, and the average, \$30.84 for all the cities."

## Legal Points for Contractors

Edited by A. L. H. Street, Attorney-at-Law

### Compensation for Use of Contractor's Equipment in Completing Work

An advance was made to a contractor on condition that his outfit, machinery, tools and equipment employed on the work under contract should remain available for use until completion of the work. Construing this agreement in the case of *Johnston vs. Cincinnati, New Orleans & Texas Pacific Railway Company*, 240 Southwestern Reporter, 429, the Tennessee Supreme Court holds that on the contractor's abandonment of the work the owner was not entitled to use the equipment, etc., without compensation therefor to the contractor. The Court remarked:

"It was probably the intention of this agreement that, if complainant abandoned the work, the railroad should have the right to use his equipment to complete it, but it seems to us to afford no basis whatever for the claim that complainant was to have no compensation for its use. If this suit presented a claim by defendants for damages for breach of contract, it might be proper to set off any recovery under that claim against complainant's claim to compensation for the use of this equipment; but we have not to deal with that, as no claim for breach of contract is now presented."

### Terms of Construction Bid Control as Against Contractor's Agreement

An advertisement for bids covering additions to a water-works system specified that before payment on the final estimate the contractor would be required to furnish a bond for satisfactory and efficient operation of the machinery and appurtenances for one year, and guaranteeing workmanship and materials on other portions of the project for five years. In the case of *O'Reilly vs. City of Cambridge*, 279 Federal Reporter, 961, the United States Circuit Court of Appeals, Sixth Circuit, holds that omission of the requirement for the guaranty and maintenance bond in the formal contract entered into on acceptance of the successful bid did not eliminate it from the contractor's obligations. The Court said:

"This condition was a part of the same paper which contained O'Reilly's bid and the specifications and the blank contract. By such bid, O'Reilly accepted this condition. All of the bidders did the same. The giving of such bond would be a distinct burden on the bidder and a benefit to the city. Since the subsequently executed contract constituted no waiver of this condition, we must conclude that its acceptance

created a valid and continuing contract between the parties."

But it is held that the contractor's failure to give the bond did not preclude his recovery on the contract where no final estimate had been made, being withheld under a claim of defective construction; the court could protect the city by the exacting of a bond as a condition to entering judgment in favor of the contractor for the amount due him.

### Governmental Interference as Excuse for Abandoning Contract

A contractor was justified in abandoning a contract to excavate a cellar and construct a wall, where the authorities of the city in which the work was to be done refused to issue a permit without expensive change in plans, and where the owner refused to stand the extra cost, holds the Rhode Island Supreme Court in the case of *Di Biasio vs. Ross*, 110 Atlantic Reporter, 415. The Court said:

"In the case at bar the plaintiff did not voluntarily abandon the work required under his contract, but was prevented from proceeding with it by order of the assistant building inspector requiring a footing wall to be placed under the cement walls. The plaintiff endeavored to agree with the defendant upon a price for the new work required, and upon failing to do this, and the defendant not offering to have it done, the plaintiff was justified in abandoning the contract and bringing suit to recover the balance due him for work and materials furnished."

### Obligation to Keep Contractor Supplied with Materials in Performance of His Contract

Road contractors were denied the right to damages based on failure of defendant to keep them supplied with a sufficient quantity of gravel to keep their employees steadily employed, in the case of *Brown & Froleys vs. Monroe County Road Improvement District*, 241 Southwestern Reporter, 39. The decision proceeds on the ground that the contract did not so require. The Court rules that it must be presumed that the parties were contracting with reference to all the conditions confronting them at the time, such as weather conditions and the difficulties to be encountered in obtaining gravel in sufficient quantities to keep the contractors' forces steadily employed. If the contractors intended that the road district should provide sufficient gravel at all times to keep their men busy, "then they should have seen to it that the contract contained such a provision."

#### **Awarding Contracts on Items Not Included as Part of the Successful Bid**

A section of the Ohio statutes requires the director of public service to award municipal construction contracts to "the lowest and best bidder." It is held by the United States Circuit Court of Appeals, Sixth Circuit, in the case of *O'Reilly vs. City of Cambridge*, 279 Federal Reporter, 961, that where defendant asked itemized bids on additions to a water-works plant, the director reserving the right to reject any and all bids or defects in the same, the inclusion of an item of wooden pipe in contracting with the successful bidder on the main part of the work was not improper, although he had bid on iron pipe; the wooden pipe being contracted for at the price bid by the lowest bidder on that item. Referring to the statute in question, the Court says:

"One well-known purpose of such a provision is to prevent favoritism among those seeking public contracts. It is at once obvious that the decisions which have reference to the awarding of a unitary contract for one matter, and some of the principles involved in such decisions, have no application to a case where it was contemplated from the beginning that the contract would be awarded in fractions according to discretionary grouping of the fractional bids. Under such circumstances the right of the director to reject any and all bids gave him the right to accept part and reject part of one bid, provided that it did not result in the separation of items which were in fact rather necessarily associated."

#### **Assignment of Contractor's Interest in Funds**

A Construction company agreed to build a road for a county under a contract reserving 10 per cent of all sums falling due on monthly estimates until completion of the work. Ascertaining that there was about \$4,700 in this reserve fund, a bank lent \$2,200 to the company on a note pledging as security the "account due from estimates from the County Court." The loan was used in carrying on the work. Later, the company became bankrupt and question was raised concerning the right of the bank to a lien on the reserve fund on its passing to the construction company's trustee in bankruptcy. The trustee asserted that the pledge failed to attach because at the time the note was given there was nothing then due and payable to the construction company. However, the United States District Court for the Southern District of West Virginia sustains the validity of the bank's claim, saying, in part (In *re Duncan Construction Company*, 280 Federal Reporter, 205):

"There is no doubt but that the contractor, subject to the rights of the County Court under the contract between the Court and the contractor, had the right to assign, either as collateral security, or fully and completely, the reserved 10 per cent then in the hands of the County Court. Of course, if the contract had not been finally completed, and the amount of the reserved money had not become due upon a

final estimate, then such an assignment would have had no effect, and would have been of no value; but where, as in this case, the contract was fully completed, and the final estimate, including the reserved 10 per cent, was paid to the trustee, then the assignment by the contractor thereof was valid and binding. This reserved 10 per cent then stood as an unmatured liability of the County Court to the contractor, and as such was assignable, and was the only asset of the kind which was assignable, at the time the note was given and the notice of such assignment accepted by the County Court."

#### **Municipal Power to Control City Contractors' Wage Scales**

The city of Milwaukee adopted an ordinance providing that "all skilled laborers employed on any work done by or for the city or for any contractor or subcontractor . . . on any building or improvement, or work on roads, bridges, sewers, alleys, buildings or other public work, shall be paid . . . not less than the prevailing wage . . . to be determined by the wages paid to members of any regular recognized organization of such skilled laborers," etc. Upsetting this provision as constituting an unwarranted delegation of the Council's powers to labor unions, the Wisconsin Supreme Court nevertheless recognizes that a council may, for itself, determine a minimum wage scale applicable to its own employees and also require its contractors to observe the scale. (*Wagner vs. City of Milwaukee*, 188 Northwestern Reporter, 487.) In the course of its opinion, the Supreme Court observes that the action of the Council in adopting the ordinance and a resolution under it, fixing certain wages on the same basis as local union wages, amounted "to nothing less than a surrender by the members of the Common Council of the exercise of their independent, individual judgments in the determination of a matter of legislative concern and an agreement that, if they act upon the subject at all, the determination of such outside body rather than their own shall control."

#### **Right of Contractor to Sublet Work**

There are numerous court decisions establishing the general rule of law that a construction contract does not imply that all of the work is to be done by the contractor. It is held by the courts that, unless the contract provides to the contrary, the contractor may sublet any part of the work. (*Neeley vs. Searight*, 15 Northeastern Reporter, 508. *Reed vs. Conway*, 26 Missouri Reports, 13. *Drumheller vs. American Surety Co.*, 71 Pacific Reporter, 25.) The same rule appears to be followed by the Canadian courts, for it was decided by a Manitoba court in the case of *MacKissock vs. Black*, 3 Dominion Law Reports, 653, that a contractor is justified, in the absence of express agreement to the contrary, to sublet such portions of the work as are usually undertaken by special trades.

## Underpinning With and Without Compressed Air

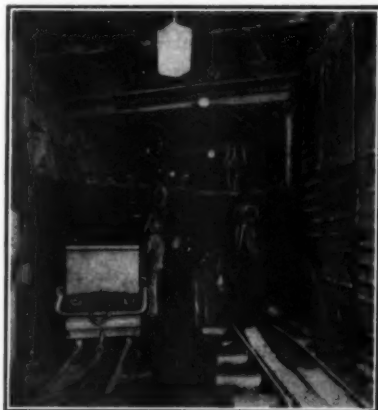
Difficult and Dangerous Work Done Safely and Efficiently by the Breuchaud Pneumatic Process and with Other Compressed Air Equipment

By Frank W. Skinner

Consulting Engineer

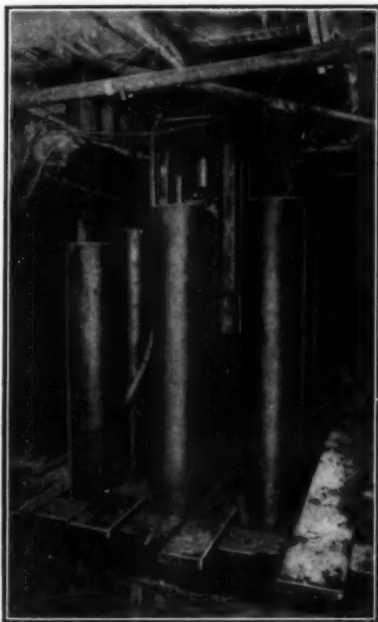
**V**ERY little constructional engineering work is more difficult and troublesome than underpinning tall and heavy structures, and none is considered more undesirable by engineers or contractors, who are likely to lose heavily both financially and in reputation through difficulties and developments which they may not be able either to foresee or overcome. Generally such work is necessitated by emergency and must often be executed under adverse conditions, with insufficient information for the preparation of preliminary plans.

Ordinarily, underpinning has heretofore been done by elaborate methods that temporarily increase the instability of dangerous structures which the work is planned to eventually safeguard. The danger is eliminated and the operations simplified when the work is done by the Breuchaud cylinder and compressed air pro-



**EXCAVATING FOR THE SUBWAY UNDER CITY HALL, PHILADELPHIA**

New foundations were successively built up on either side to help carry the building load



**DRIVING STEEL PILES IN CELLAR**

A group of long, hollow steel piles driven in a pit in the cellar of a building by a heavy compressed air hammer suspended from the basement floor and working with very small clearance

cess, which is well adapted to the most difficult conditions, even those that make the application of the old methods very costly and dangerous, or impossible.

Underpinning in its broad sense is replacing, repairing or sometimes only safeguarding the wall or pier footings of a building, bridge or other structure. It is required for various reasons, including the inadequacy or unreliability of existing foundations because of defects of design, material or workmanship; deterioration; increased load; change in support under the foundations; present or threatened softening, scouring, or bleeding of the material liable to cause undermining and settlement; vibrations due to impact or other disturbances; adjacent excavations; the increase or elimination of ground water; or to various other causes. Underpinning operations are likely to be more difficult and dangerous the taller and heavier the structure, the deeper the foundations, the more delicate the contents of the building, the closer and more important the adjacent structures, and the softer and more treacherous the soil.

Foundations for structures on land or in the water are of three general types, namely: those carried down to rock; those supported by the bearing power of the soil, either near the surface or in pits; and those supported wholly or

largely by the frictional resistance of the soil, as is the case with many pile foundations and some pier or caisson foundations that are sunk through soft materials and do not reach a hard stratum.

Foundations on rock seldom or never need underpinning if properly designed and constructed. Foundations with their bearings on the natural soil are most likely to need underpinning, especially if near the surface, if the soil is of a treacherous nature, or if it is disturbed by subsequent operations near-by at a level below the bottom of the footings. Frictional foundations are generally carried down so deep that they are beyond the influence of ordinary operations in the vicinity, and are most likely to need underpinning on account of changes in their loadings or through the deterioration of the foundations themselves, as may occur when wooden piles decay.

#### Ordinary Underpinning

The first step in underpinning is to make an accurate survey of the structure and record all existing injuries and imperfections, so as to locate the weak points and incipient failures and quickly detect new or progressive injuries during the underpinning operations; the second is to remove obstructions and secure access to and clearance for the work; the third, to strengthen and safeguard the building against any injury or loss of stability possible from the subsequent underpinning operations.

It is sometimes necessary to repair not only the foundation, but the building itself, and to brace the walls thoroughly and shore them before even an examination can be made. After this is done, excavations are generally made around the old foundations, exposing them for inspection, repairs or replacement. If they can be partly or wholly replaced or extended to rock or satisfactory hard stratum at a moderate depth, this is ordinarily done in successive sections; if not, they may be carried down to better bearings at what is considered a safe depth, or they may be strengthened, extended, or protected according to requirements.

#### Ordinary Shoring and Underpinning

The most common way is to transfer the weight of the superstructure to the temporary new surface foundation, remove the old foundation, excavate to satisfactory bearing, construct new foundations there, transfer the weight of the building back to them and remove the temporary supports. This involves "shoring," or the temporary support of the structure, and underpinning proper, or the actual revision of the foundations.

Often the wall is braced with inclined exterior adjustable struts, and holes are cut a few feet apart in the walls just above the foundations, and in them are inserted transverse beams or girders, called needles, with their ends carried on timbers that distribute their loads over the surface of the ground at a distance from the wall. Jackscrews or their equivalents are operated under the ends of the needles to lift the wall slightly, usually developing a crack between it and the foundation, and

permitting the latter to be removed and a trench excavated under the wall between the needle supports.

In the trench the new foundation, usually of concrete, is built up to the needles and between them, close to the old wall, which is thoroughly wedged to bear upon it, after which the needles are slightly lowered, transferring the weight of the wall to the wedged support and imposing concentrated loads on the new footing which tend to develop any potential settlement there and produce permanent equilibrium. The needles are then successively withdrawn and replaced by completing the intermediate portions of the foundation and wedging them tightly against the bottom of the wall, thus completing its support.

During these operations it is necessary to constantly take measurements and to adjust the jackscrews to compensate any settlement. Carelessness is likely to result in serious cracks or destruction of the walls.

#### Simple Needle-Beam Method

Underpinning a tall, heavy building under the most favorable conditions by the old-fashioned method is illustrated by the Decker Building, New York, with a 13-story brick wall, 100 feet long, that weighed, with its load, about 30 tons per linear foot, besides containing iron columns carrying loads of 500 to 650 tons each. The wall was temporarily supported on double tiers of 15-inch I-beams 28 feet long, with each end carried on four lines of 12x12-inch timbers parallel to the wall. These, in turn, were carried on 20-ton and 5-ton jackscrews placed as close together as could be conveniently operated on a plank platform on top of a pair of lower parallel sills on timber cribs built on concrete piers carried down to solid rock in sheeted pits.

After the needle-beams under a section 30 or 40 feet long were jacked up to lift it  $\frac{1}{4}$ -inch, the footings were removed and a trench was excavated from 5 to 15 feet deep to rock between the cribs, and new foundations were built in it. As soon as the new masonry was hard enough, the weight of the wall was transferred to it from the needles, compressing the new brickwork a fraction of an inch, and the needles were removed, their places filled by extensions of the new foundations and the operations repeated on successive sections of the wall until the whole was finished. During the operation temporary loads of 100,000 pounds per square foot were carried on the foundations, and accurate levels were taken daily on fourteen bench marks. The wall was thoroughly braced by inclined struts and by heavy horizontal timbers reaching across the cellar excavation.

#### The Breuchaud Method

The Breuchaud method of underpinning, which has been very extensively used for some of the tall buildings in New York, eliminates the delay, danger and expense of shoring and of disturbing previous old foundations. It consists essentially of jacking down hollow

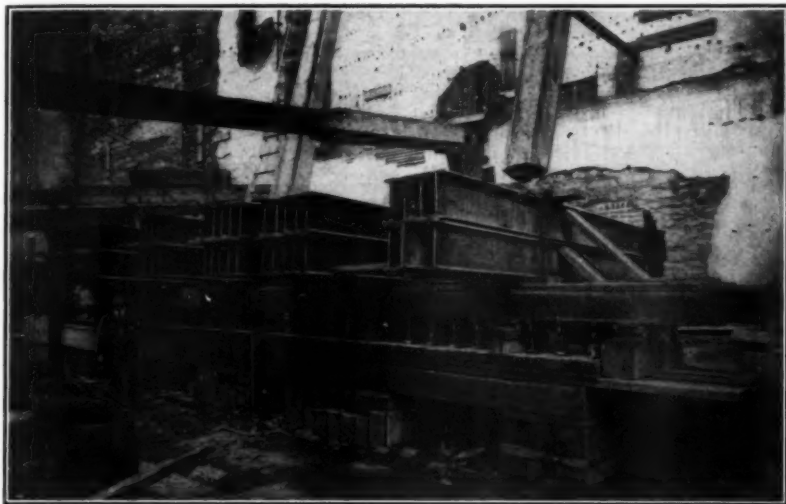


cylinders under the old foundations until they reach satisfactory bearing and are filled with concrete and adjusted to permanently support the weight of the wall. This process employs the weight of the structure itself to afford reaction for the jacks, does not involve the removal of any appreciable amount of the old foundation bearing or the disturbance of the footings, and therefore does not impair the original support of the building.

It provides increased rather than diminished support during the process of underpinning, and has the very great advantage that it occupies the minimum possible amount of space for the underpinning work and may be done wholly

wall and distribute the pressure over a sufficient area to provide for the reaction of the jacks in forcing down the cylinders.

The cylinders, from 30 to 80 inches in diameter, are usually of steel pipe with sleeve joints for the smaller sizes and of cast iron with interior bolted flanges for the large sizes, and are used in sections from 3 to 12 feet in length. They are sunk with open ends, permitting the material encountered to rise inside and be frequently cleaned out at intervals between the jacking or while the jacks are being shifted. For the smaller sizes the material is generally excavated with scoops of other special tools or blown out by compressed air, care being



#### UNDERPINNING A THIRTEEN-STORY BRICK WALL WITH I-BEAMS

The wall was temporarily supported on double tiers of 15-inch I-beams with each end carried on four lines of 12 x 12 inch timbers parallel to the wall. The timber cribs rest on concrete piers carried down to solid rock

from either face of the wall. It does not necessarily require the use of any needle-beams, inclined struts or any other shoring, and may be done on the exterior face of the wall without entering the building or may be done from the interior of the building without at any time occupying the exterior space.

In many cases in New York City old footings were carried to ground-water line, and in order to avoid difficult excavation and pumping in the bottom of the pit, the jacks are often installed above the bottom of the old footing. For this purpose the face of the footing, and perhaps the lower part of the wall, is recessed to form a chamber from 2 to 4 feet wide and deep, and from 5 to 8 feet in height, large enough to receive the first section of the cylinder, jacks and reaction beams seated above it. At the top of this vertical recess there is cut a horizontal recess in which are seated one or more I-beams to take bearing against the

taken, if the bottom of the pipe is in a quicksand stratum, to avoid a run-in of quicksand that might cause injurious settlement to adjacent structures or to the foundations of the building itself.

If the pipe has a diameter of 30 inches or more, it is possible for a man to enter and excavate the material by hand, depositing it in a canvas bag, which is hoisted through the pipe and emptied. As the sections of the pipe are driven down, additional sections are connected on top and flange-bolted to them for the larger sizes.

#### Pneumatic Pressure Applied

When the lower section reaches ground-water level, a special upper section is installed, having top and bottom horizontal diaphragms with gasketed air-tight doors, both opening downward. This section is fitted with valves and gages and serves as an air lock through

which a man enters the cylinder after air pressure is applied to expel the water from the lower part of the cylinder. In this way the cylinder can be sunk a maximum of 100 feet through water and quicksand to bearing on bottom that can be carefully examined and leveled, and in some cases covered with thick plates to increase the bearing and strength of the lower end of the cylinder.

This method was invented by Jules Breuchaud, President of the Underpinning and Foundation Company, who first applied it to the underpinning of the 114-foot-high brick wall of the Queen Building, New York, the original footing of which rested on fine sand above ground-water level and about 36 feet above the rock. The footing, 8 feet wide, was subjected to a load of about 12,000 pounds per square foot and was underpinned by cast iron cylinders 33 inches in diameter that were loaded to about 350 tons each.

The same process was used for underpinning many other tall and heavy buildings in the financial district of New York, previous to making deep excavations alongside or sinking caissons in quicksand for the foundations of new buildings that would inevitably cause some subterranean displacement of soil and bleeding of fine wet sand likely to produce settlement in the old buildings and subject them to heavy stresses, distortions and serious injury. In doing this work, compressed air was freely used, not only for expelling the water in the cylinders, but for operating drills with which the masonry was honeycombed and broaches with which the brick-work was cut out. Later it was found generally cheaper, quicker and more advantageous to drive small and more numerous piles with air-operated hammers, and to clean out the material with compressed air blow-outs, which obviated excavating and hoisting equipment. In any case, a very small working force suffices, and is divided into units of two or three men who are operating the compressed air drills and broaches for honeycombing the masonry where recesses have to be cut in the old wall. Another group places the reaction beams, handles the cylinders and acts as general utility men, and the third group consists of one compressed air man and two jack men to drive the cylinder under the wall. Besides this, there is probably one man at the derrick hoist and perhaps one

or two extra men and a superintendent. Usually, however, two or more cylinders are driven simultaneously at points as widely separated as convenient, and an extra group of excavating and jacking men, drillers and broachers are required for each simultaneous cylinder.

The cylinders are always driven at least to bearing on the hard-pan and frequently are carried several feet through the hard-pan onto the solid rock immediately underlying it or perhaps separated from it by a pocket of quicksand. In some cases the cylinder might reasonably be stopped soon after penetrating the hard-pan and the remainder of the excavation made beyond their lower ends, but it is generally customary to carry them to the extreme bottom of the pit, and thus secure the benefit of the compressive strength of the cylinder metal throughout the full length of the column. The cylinders are generally driven by one or two 60-ton or 100-ton hydraulic jacks, sometimes operated by hand with two men each, and sometimes operated by a pump actuated by compressed air, necessarily provided for the interior of the cylinders.

In some cases walls so dilapidated that they would not hold together unless continuously supported, have been successfully underpinned by this method, even when it was necessary, as in the case of the work done for buildings adjoining the Mutual Life Insurance Building, New York, to strengthen and even encase the lower part of the wall by pairs of deep plate girders bolted to and through it, and providing satisfactory bearings for the hydraulic jacks.

After the cylinders are driven to satisfactory bearing on the rock surface, they are filled with concrete, and heavy iron or steel cap plates are seated on them, bedded in grout. Connections are then established between the cap plates and the reaction beams by means of short vertical steel columns, securely wedged to bearings, adjusted to take the required proportion of the weight of the walls. The recesses in the brick work around the beams and struts are afterwards filled solid with new masonry and grouted, completing the work.

ACKNOWLEDGMENT.—Illustrations by courtesy of *Compressed Air Magazine*.

## Bucyrus Enlarges Plant

The Bucyrus Company, South Milwaukee, Wis., is making extensive enlargements to its plants at South Milwaukee, Wis., and Evansville, Ind. In the South Milwaukee plant, where all the larger machinery is built, a new gray iron foundry, 276 feet in length, is now under construction. The old gray iron foundry, now the south end of the steel foundry, is being converted into a cleaning room with annealing ovens, sand blast rooms and a welding

room. A large addition is also being made to the steel foundry moulding floor, and an electric furnace is being installed. Extensive improvements are also being made in the foundry storage yards.

At the Evansville plant, which specializes in the manufacture of small revolving shovels, the machine and erecting shops are being considerably enlarged to enable the company to handle its increasing shovel business.

## Bituminous Road Treatment---Materials and Apparatus

**T**HERE are various kinds of bituminous material now in use for road treatment.

First, there are the thinner or lighter grades of asphaltic oils or tars, the thinnest of which may be applied cold, and others at a comparatively low temperature. Such materials are chiefly used for dust laying or temporary surface treatment for the preservation of the road surface. Secondly, there are the heavier forms of petroleum asphalts and natural asphaltic products and also the heavier grades of refined tar. Such materials are used for road construction or surface treatment or for more permanent maintenance. All such material must conform to certain required specifications, which vary somewhat in different localities, while in a general way they are similar.

The success of all kinds of road building depends very largely upon proper foundation and drainage. There is such a diversity of climatic effects, nature of soil, subsurface drainage conditions, character of traffic, etc., that the method of construction or treatment must depend upon the ability, experience and judgment of the engineers in charge of the work. Fundamentally, extreme care should be taken to ascertain with the greatest possible accuracy the existing conditions, and to construct the foundation properly and of sufficient stability to sustain present and future traffic.

The common bituminous pavements are bituminous macadam, in which the binder is applied by the penetration method; bituminous

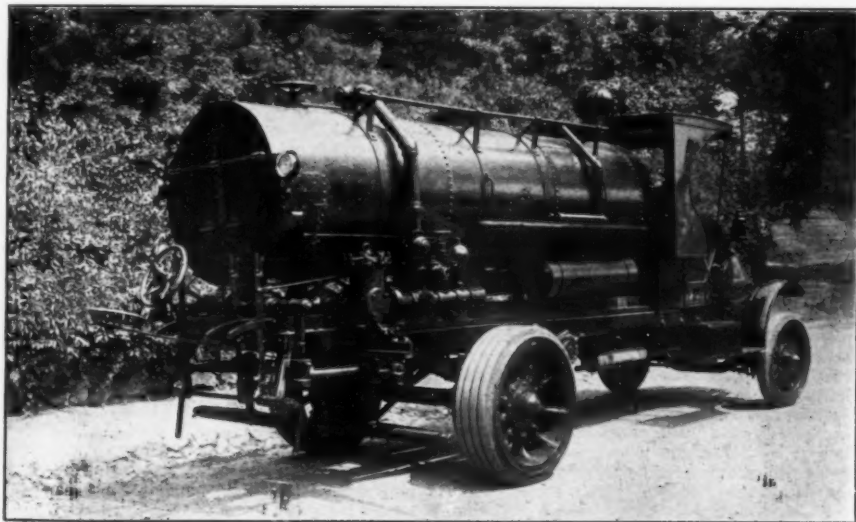
surface over cement or brick base; bituminous surface over water-bound macadam; bituminous treatment over broken or scarified macadam; and bituminous treatment of sand or gravel roads.

### Bituminous Macadam

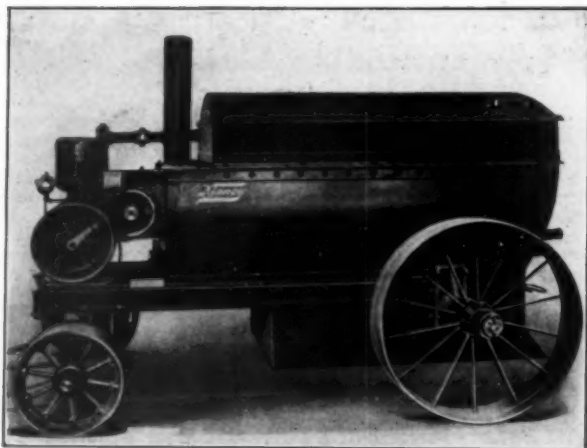
Bituminous macadam is best constructed by applying the heavier bitumens, after they are properly liquefied by heat, evenly and uniformly upon successive layers of broken stone which have been placed upon an adequate foundation. Each layer is properly rolled by a steam roller until of uniform contour and well compacted. The heated bitumen should be applied by mechanical sprayers so constructed as to force the material as deeply as possible into the voids or interstices between the stone and to cover thoroughly each fragment of stone with bitumen. The successive applications will then form a homogeneous mass, thoroughly compacted by rolling. The bitumen should be applied under pressure at as high a temperature as practicable without injury to the material. The total amount of bitumen used in all of the applications will average one to two gallons to each square yard of surface, or as conditions may require.

### Bituminous Surfacing for Brick and Cement Roads

The bituminous surface over a brick or cement road is especially adapted to roads having to sustain heavy traffic. It affords a



A KINNEY ROAD OIL, TAR AND ASPHALT DISTRIBUTOR, AS USED BY MANY ROAD DEPARTMENTS AND CONTRACTORS



**HORSE-DRAWN TYPE OF PRESSURE DISTRIBUTOR**

practically noiseless, dustless and water-proof surface which may be economically renewed as required. In applying it, the cement or brick surface is thoroughly swept and flushed with water to remove all dust and extraneous material, then sprayed with bitumen heated to about 250 degrees Fahrenheit, in the proportion of about one-quarter gallon to the square yard of surface. This is then covered with stone chips or clean gravel to prevent adhesion to the wheels of the roller. Another coat is then applied in the same manner and the same proportion, covered with gravel or chips, and thoroughly rolled, producing a smooth and even-wearing surface.

#### **Treating Old Water-bound Macadam**

In the bituminous treatment of a water-bound macadam road the surface is thoroughly swept, removing all loose material and even exposing the top course of broken stone. It may then be sprinkled with water, and while wet, sprayed with bitumen heated to about 300 degrees Fahrenheit in the proportion of about one-half gallon to the square yard, or two successive applications of one-quarter gallon per square yard, and covered with sharp stone or gravel. In this treatment it is not necessary to use the steam roller, as the regular traffic is relied upon to compact the treated road. Special care is taken to thoroughly sweep and water the surface before applying the bitumen.

For scarified macadam the treatment is practically the same as for water-bound, except that the surface is first scarified or broken up by a scarifier, and then reshaped and smoothed by a roller before applying the bitumen as in regular bituminous treatment for water-bound macadam.

#### **Surfacing Sand and Gravel Roads**

In the treatment of sand or gravel roads, first, proper attention is given to foundation

and drainage. The road is then shaped to the required crown and rolled until smooth and compact. The subgrade is sprinkled with water, and four or five coats of bitumen are applied successively, distributing a light coating of sand upon each application, also sprinkling each course with water. All inequalities are then carefully filled up and the surfaces covered with clean gravel and rolled until well compacted. This treatment affords an excellent road at low cost, which will withstand ordinary automobile or horse traffic and is practically dustless and noiseless.

The bituminous covering should be evenly and uniformly applied. Streaks or laps should be carefully patched with bitumen before covering with grit. All bare places if neglected will show up in the completed work, to the detriment of the finished surface of the road. The gravel or sand covering should also be spread uniformly, if possible, by a mechanical spreader and in proper quantities to avoid waste or separation of the courses of bitumen. In applying bitumen to macadam or cement surfaces, all dirt or loose material must be carefully swept off or otherwise removed, to insure adhesion to the surface.

#### **Apparatus**

In the handling of all kinds of bituminous materials which solidify, or partly solidify, when cold, it is first essential that such material be properly liquefied by heat in order that it may be sprayed upon the road surface. When properly heated, the material may be readily and most efficiently sprayed, preferably under pressure by mechanical sprayers. Many types of equipment have been devised for this purpose. The most practical is a distributor which will properly heat the material and distribute it in the form of an atomized spray under pressure in such volume as is desired, the advantage being that the pressure forces the material into the voids between the stone much more thoroughly and effectively than it will flow by gravity. The apparatus should be constructed to be drawn by horse, motor truck or tractor, and should be adapted to the varying conditions under which it may be used. It should be constructed so as to properly distribute any and all kinds of bituminous materials, either hot or cold, and in the volume desired.

The Kinney Manufacturing Company, 3529 Washington street, Boston, Mass., is manufacturing one of the most effective pieces of apparatus for handling all kinds of bituminous materials for road treatment. This Kinney patent heater and distributor is the result of

many years' experience and knowledge of the requirements of this method of road treatment. It is furnished in both automobile and horse-drawn types, using the Kinney pump for furnishing pressure. It is also equipped with an improved heating and circulating system to insure the highest possible heating efficiency with practically no danger or liability of injury to the material from overheating.

This distributor is also furnished in a special type of construction adapted to handling heavier materials when used in barrels instead of tank cars. In this machine the heat is derived from wood, coke or coal fires, in similar manner to the use of familiar makes of tar kettles. The machine may also be equipped with the Kinney heating and circulating system, using kerosene oil burners as in the auto distributors. This apparatus is of special advantage in the work of maintenance or for more limited construction work. In the handling of heavier grades of bituminous materials, which require heating to a higher temperature, especial care must be taken that there is absolutely no moisture allowed to come into contact with the material in the process of heating. A slight amount of water will cause the material to foam or froth and become useless for road work. This possibility is always present when steam is used for heating. No steam is used in any type of Kinney apparatus, the heat being derived directly from kerosene oil burners in the automobile type of apparatus, and from wood or coal fires or kerosene burners in the Handy heater and distributor described immediately above. In the automobile type of apparatus the heat from the kerosene oil burners is conveyed through tubes placed in the interior of the tank. This, with the circulating system, insures the material from the introduction of moisture and from burning or overheating. In distributing the material precautions must be taken to prevent driving over the bitumen before it is covered with sand. Otherwise, bare spots will be exposed, which will have to be patched up before the road can be finished.

Excessive use of bituminous materials should be avoided. This applies to all classes

of work. Too much binder will result in an uneven and wavy surface and will exude toward the shoulders of the road, while the proper amount, if skillfully and evenly applied, will not fail to give the desired results and reflect credit upon the road builders.

#### Applying Materials for Dust Laying

Another and very important department of bituminous treatment is the use of lighter oils or tars for dust laying or temporary road preservation. Such material, if properly applied, has been found very satisfactory, from an economical as well as from a sanitary standpoint. The oil effectively lays the dust and requires but a few applications during the entire season. It also, to a large extent, protects the surface of the road from the wear and tear of automobile travel.

Among the earlier methods of applying road oils of this kind was the process of emulsifying the oil by the introduction of alkalis and later by the use of self-emulsifying oils. The object was to so combine the oil with the alkali or other solvent that when mixed with a certain amount of water it would form an emulsion, and that when it was distributed a small amount of oil would be left upon the surface after the evaporation of the water or emulsifying medium. The effect was that in the earlier and also in the later periods of the sprinkling season, when the evaporation was slow on account of low temperature, the street remained in a more or less impassable condition for a long while, or until the volatile material had evaporated, leaving the desired deposit of bitumen. This method has to a great extent been superseded by the use of improved mechanical sprayers or atomizers, using the product without being emulsified.

The excessive use of oil for dust laying by any method is not only wasteful, but is a nuisance and merits public condemnation. On the other hand, if rightly applied by means of a proper spraying apparatus, oil is a most satisfactory and efficient dust layer, requiring but one or two applications during the entire season, with no inconvenience to pedestrians or injury to vehicles.

### Cletrac Makers Expand

THE Cleveland Tractor Company, Cleveland, Ohio, manufacturer of the Cletrac, a medium-weight tractor, is to be reorganized as the Allene-Zeder Motors Company, to manufacture and market the new six-cylinder car which is being designed by F. M. Zeder, formerly chief engineer of the Willys Corporation and the Studebaker Corporation. The reorganization will be brought about by adding approximately \$5,000,000 of new capital to the present assets of the Cleveland Tractor Company, resulting in a corporation with a capital of \$10,000,000 of preferred stock and 200,000 shares of no par common stock.

A new corporation, subsidiary to the Allene-Zeder Motors Company, will be organized under the name of the Cleveland Tractor Company and will continue the marketing of Cletracs through its present distributors and dealers. A new 1-ton truck, embodying advanced details in design, engineered by Rollin H. White, will be added to the Cletrac line in the near future. The reorganization plan is practically ready to submit to the stockholders of the Cleveland Tractor Company, and the cooperation of several of the larger stockholders practically assures its adoption and rapid prosecution.



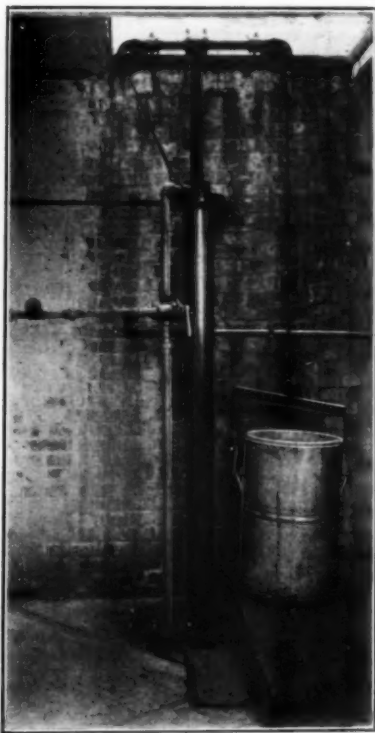
## A Hydraulic Ash Hoist

ONE of the problems in any building construction is provision for the mechanical removal of ashes. The Hydraulic Ash Hoist Company, 835 Springfield Avenue, Irvington, N. J., has placed on the market the Centaton hydraulic ash hoist. This hoist has been operating under exacting conditions in Newark, N. J., high schools for seven years. It is built to operate under various landing conditions: it is made in the disappearing telescopic side-walk type; it can operate as a cellar window lift; and in many cases it is installed for operation inside the building, but to handle the load in an outside areaway—a method which is sometimes advisable for an old building having an uncovered areaway that the owner does not wish to go to the expense of enclosing.

It is claimed that the hoist can be easily installed in new or old buildings without special construction work. The work required for installation consists of drilling holes in the floor and walls for expansion bolts and making the necessary water and sewer connections. The hoist is made in a substantial manner, with the cylinder and plunger of solid brass, precluding any possibility of corrosion and loss of power through slippage of water past the plunger. The plunger rod guide is composed of a compressed and almost frictionless hydraulic packing, making repacking a matter for attention at very long intervals.



THOMAS J. WASSER



ASH CANS READILY REMOVED BY HOIST

### New President of A. R. B. A.

THOMAS J. WASSER, who was elected to the presidency of the American Road Builders' Association at the adjourned meeting on June 15, has had an experience of 32 years in general construction. At the age of 21 he began working on macadam highway construction for B. M. and J. E. Shanley, general contractors, of Newark, N. J. Following this, he served successively with the Long Island Railroad; the Consolidated Traction Company of N. J.; the Sanford & Stillman Company, General Contractors, Jersey City; Robert W. Hunt & Company; and as engineer in charge of the preliminary work on the Hackensack bridge and the Newark plank road.

He became Engineer of Hudson County in 1913 and designed and constructed most of the Newark turnpike. Resigning that position in 1920, he was selected by the reorganized State Highway Commission to be State Highway Engineer of New Jersey.

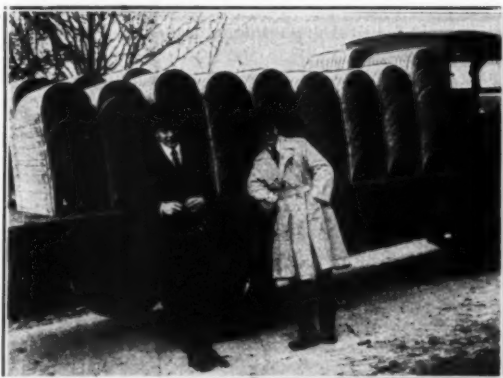
## The Advantage of Nestable Culverts

Savings in Transportation Costs and Handling

**A**NY type of corrugated metal culverts offers considerable convenience over the more bulky types of culvert forms. If other points of convenience are added in shipping, handling and storing the culverts, there is a distinct advantage when the final costs are computed. The Chattanooga Road Machinery Company, Chattanooga, Tenn., manufactures a nestable culvert which has a number of features of interest to the road engineer and contractor.

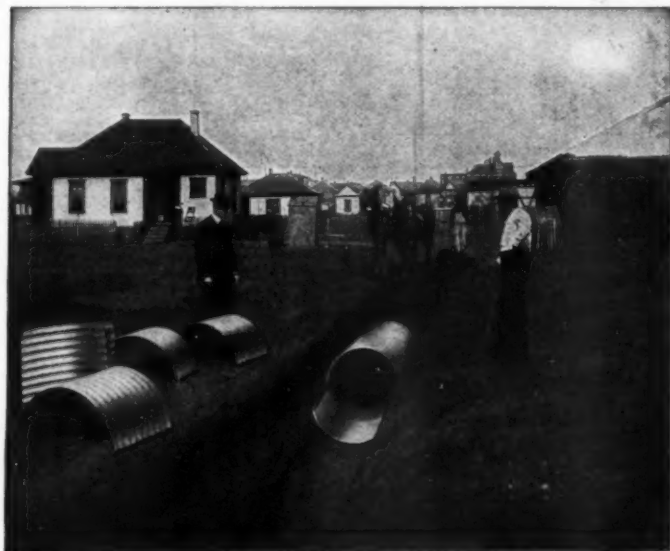
These culverts are built up in semicircular sections keyed together on the job, thus making a considerable saving in haulage space, as they do not require numerous teams and wagons nor a great amount of labor in unloading. The heavy-gage metal used in the making of these "Butt-Joint" sections is reinforced by lateral strips hot welded to each edge to prevent any single section from spreading or getting out of shape through rough handling or the shocks ordinarily received in cross-country shipping.

An interesting demonstration of the strength of this type of culvert is shown in the series of tests which were run on plain cylinders, corrugated riveted culvert and Butt-Joint nestable culvert pipe. Each cylinder was similarly



**CULVERTS NESTED FOR EASY TRANSPORTATION**

supported at the base and had a like standard at the top, on which were piled galvanized sheets as a load. The plain cylinder, without the reinforcement of corrugations, supported three galvanized sheets with a combined weight of 120. The corrugated riveted culvert supported 90 sheets of approximately the same individual weight, or nearly 30 times the weight carried by the plain cylinder. The Butt-Joint



**NESTABLE CULVERTS DISTRIBUTED FOR LAYING**

nestable culvert supported 140 sheets of the same weight, or showed over 45 times the strength of the plain cylinder.

These culverts are made in all standard sizes from 8 to 84 inches in diameter, and for special requirements are furnished up to 96 inches in diameter. The construction is the same in the larger sizes of culverts as in the smaller.

The larger sizes, which in most culverts require an entire flat car for shipping, can be nested and shipped in comparatively small space.

These culverts are also made with flat bottoms for use where they are needed for shallow drains, because of the lack of headroom. Butt-joint culverts are adapted for city, steam and electric road uses.

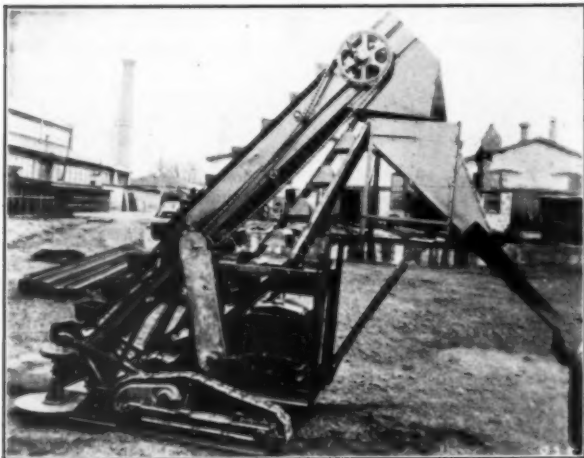
## Loading Trucks at 2 Cubic Yards per Minute

**T**HE new self-feeding bucket loader, known as Model 42, which has recently been announced by the Barber-Greene Company, Aurora, Ill., demonstrated that it had a capacity of  $2\frac{2}{5}$  cubic yards per minute in loading cinders for the Ryan Cinder Company, Chicago, Ill. Some of the trucks which were loaded by this machine were fitted with sideboards, giving them a capacity of 12 cubic yards of cinders. These trucks were loaded by the machine in 5 minutes, under the control

which handled  $1\frac{1}{4}$  cubic yards per minute, has been speeded up to take care of  $1\frac{3}{4}$  cubic yards per minute. The crawlers on which the machine is mounted are now 10 inches wide instead of 8, and 60 inches long instead of 58 inches. A new Buda engine equipped with oil and water pumps furnishes the power. The same disc feeder that was used on the first Barber-Greene bucket loader is used on the new model. This feeder consists of two 36-inch flat steel discs, placed in a horizontal plane at the lower end of the boom and driven by gears so that they both turn towards the center, thus bringing material to the buckets. A better arrangement for controlling the disc is also provided.

A measuring hopper with a variable capacity up to 21 cubic feet can be furnished for the use of road contractors, although standard equipment is a swivel spout which can be turned from the operator's platform. The discharge height of the machine is 9 feet 6 inches. Another new feature in the Model 42 machine is the adoption of the standard Cotta truck transmission, giving three speeds forward and one reverse.

Cinders can be loaded at the rate of  $2\frac{2}{5}$  cubic yards per minute. It has also been found possible to handle heavier material, such as coal, sand, gravel or crushed rock, with one man at the rate of  $1\frac{3}{4}$  yards per minute into trucks, wagons, carts or conveyors.



A LOADER WITH SELF-FEEDING DEVICE

of one man. This speed is made possible by generally increasing the efficiency of the loader. In handling crushed stone and such other heavier materials, the original machine,

also been found possible to handle heavier material, such as coal, sand, gravel or crushed rock, with one man at the rate of  $1\frac{3}{4}$  yards per minute into trucks, wagons, carts or conveyors.

## A Ladder Safety Code

**T**O reduce the number of accidents arising from the faulty construction of ladders, both commercial and temporary or field built, the Ladder Code Committee of the American Society of Safety Engineers, with which the Associated General Contractors of America is cooperating, has drafted a standard code which is about ready for final approval. This code lists in four groups those woods recom-

mended for use in ladders and provides minimum dimensions for side rails and other parts, based upon the respective strength of the various groups. Classification of the woods and their significant characteristics as affecting ladder construction was supplied by the U. S. Forest Service, which made extensive investigations of wood in connection with airplane work. Stipulations are also provided for metal ladders.

## ASSOCIATED GENERAL CONTRACTORS

### NEWS NOTES AND COMMENTS

## Materials, the Fuel of Construction

A. G. C. Protests Government Orders Which Mean Shut-down of 80 Per Cent of All Construction Work East of Mississippi as Soon as Coal Strike Is Settled

**O**RDERS issued by the Interstate Commerce Commission July 25, and amended on August 4, giving demand for open-top cars for coal for any purposes priority over requests for open-top cars for other purposes will probably mean a shut-down of four-fifths of the construction projects under way east of the Mississippi River as soon as the coal strike is settled unless the order is modified before that time. In this order the Commission establishes five classes of coal which shall have priority in the following order:

1. Coal for special purposes designated by the commission or its agent.
2. Coal for transportation, public utilities, Government institutions, domestic use.
3. Coal consigned to Lake Erie ports for trans-shipment to ports on Lake Superior.
4. Coal for manufacture of foodstuffs, and medicines, and containers thereof.
5. Coal for other purposes.

What this means for construction is best expressed in the following petition which has been submitted to the Commission by the Associated General Contractors of America:

August 5, 1922.

The Honorable,  
The Interstate Commerce Commission,  
Washington, D. C.

Gentlemen: This petition of the Associated General Contractors of America respectfully shows that—

1. Your petitioner is the representative of approximately fifteen hundred of the principal general construction contractors of the United States and is vitally interested in the entire construction industry, both in construction work proper and the manufacture, production and transportation of construction materials.

2. There are at the present time actively engaged in actual construction work, east of the Mississippi River, over 1,300,000 men on projects now in process of construction of the total value of approximately \$1,700,000,000; that there are actively engaged in supplying construction material to carry on these projects approximately 1,500,000 men; so that the uninterrupted continuance of this industry is vital to the lives of 2,800,000 workers, and of course to their families whom they support. It can be fairly stated that over 11,000,000 people are

dependent for their daily support upon the wages of these workers in the entire construction field east of the Mississippi River.

3. The construction program now in progress is largely directed to relieving the acute housing shortage in the United States and through the construction of highways to making more accessible outlying districts, which in turn has its effect on both housing and costs of living. Any radical interruption in that industry at this time, therefore, will have a far-reaching effect upon the health and comfort of the whole people.

4. The construction industry, as is well known, is largely seasonal. To interrupt the program which is now at its peak in the construction field at this time, even for a few weeks, would so disarrange the program as practically to throw over into another year many of the vital projects now under way, resulting in enormous losses.

5. The order issued by your Honorable Commission under date of July 25, being known as Service Order No. 23, provides, in effect, that all of the cars suitable for the loading and transportation of coal, which includes practically 90 per cent of the open top cars of the country, shall be used exclusively if demanded for the transportation of coal for all purposes, not only those of emergent necessity for which priority rating is given by your Commission, in numbers 1, 2, 3 and 4 in said Order, but also of coal for all other purposes.

6. Recognizing that it is the purpose of the Commission to supply fuel to the essential industries of the country with the least possible interruption to the general business of the country, we believe that Service Order No. 23 fails to take cognizance of the far-reaching effect it will have upon the transportation of construction material, nearly all of which is transported in open top cars. Service Order No. 23 will, in effect, withdraw nearly all open top transportation facilities from the construction field as soon as the mines are opened. This will mean the immediate shut-down of an industry which furnishes the livelihood of 11,000,000 people, as has been pointed out. It is respectfully submitted that an order intended to insure fuel delivery to keep industry going, but which is so drastic as to practically stop the operation of the second largest industry in the country, not

only defeats its own purpose but also makes matters worse.

7. With the reopening of the mines the demand for cars for coal loadings will be not less than 320,444 cars per week, which number can actually be loaded with coal if available.

The maximum number of open-top cars of all kinds which the railroads can supply, taking into account the present large number of un-serviceable cars, will be 324,000 cars per week, of which only 291,000 will be suitable for the loading and transportation of coal, leaving, under the operation of the Order, only 33,000 open-top cars for all other purposes.

That weekly requirements for such cars for the transportation of other commodities will be:

	Cars
Construction materials .....	85,000
Ore .....	40,000
Limestone .....	10,000
Coke .....	10,000
Miscellaneous .....	10,000
Total .....	155,000

This leaves available for all purposes other than the transportation of coal only 21 per cent of the number of cars needed, and these very largely cars unsuited for carrying the commodities for which they will be wanted.

8. We fully recognize the fact that the general welfare of the country will be promoted by giving preference to the transportation of fuel for the first four priority classes enumerated in Service Order No. 23, but to give the transportation of fuel for all other purposes a priority over the transportation of all other commodities, and especially construction materials, upon which 11,000,000 of our people are dependent for their daily bread, will not carry out the purpose of the Commission and will have an effect which will disrupt the business of this country in a way that will work a hardship far beyond the requirement for the transportation of fuel for a general purpose after the necessary emergency purposes are met.

9. We desire to make the point that after the four necessary emergency cases are met, fuel should take a class along with other materials necessary for the normal business of the country. What fuel is to manufacturing, construction materials are to actual construction. *In a word, building materials are the fuel of construction.*

10. With the enormous demand for coal which will accompany the reopening of the mines, so few cars will be available for construction materials, under the terms of Service Order No. 23, that four-fifths of all construction projects east of the Mississippi River will be obliged to close down.

11. Your petitioner respectfully prays that Service Order No. 23 be amended so as to provide that after the railroads have supplied open-top equipment sufficient to carry the fuel required by the first four priority classes enumerated in said Order, that they be directed to supply open-top equipment without preference to all other commodities, including coal.

12. If it would better serve the purpose of the Commission to permit construction materials to have a parity of classification with the fifth class of priority for fuel, then your petitioner prays that the said Service Order No. 23 be amended so as to direct such furnishing of open-top equipment to construction materials by the carriers.

13. If the Commission desires further facts along the line of those stated above in this petition, your petitioner stands ready to answer its call and to furnish all data in its possession.

14. Your petitioner respectfully prays an opportunity to be heard in support of the prayer of this petition.

Respectfully submitted,  
ASSOCIATED GENERAL CONTRACTORS OF AMERICA,  
By: R. C. MARSHALL, Jr.,  
General Manager.

### A. G. C. Biography

T. T. Flagler, to put it briefly, is handling construction work in the vicinity of Atlanta in connection with the Flagler Company. He was born in Lockport, N. Y., in 1880. He located in Atlanta some time before the company was formed, but he obtained his first experience in construction from the Standard Oil Company, after graduating from the University of Pennsylvania in 1903. In recent years the work of this company has extended outside Atlanta to Mobile, Birmingham, Jacksonville, Savannah and other southern cities, where apartments, warehouses and factories have been built. Mr. Flagler is Vice-President of the A. G. C. at the present time.



T. T. FLAGLER  
Pres. T. T. Flagler Co., Atlanta, Ga.



# HANDY CATALOGS

## HELP CONTRACTORS

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

### A NEW CONTINUOUS ROOFING KETTLE

The Barber Asphalt Co., Philadelphia, Pa., has just announced its new Iroquois continuous roofing kettle, which embodies distinctly new ideas and economies beneficial to roofing contractors.

### A VERSATILE TRACTION STEAM SHOVEL

A steam shovel with skimmer, ditcher and clam shell buckets for road grading, trenching, back filling, cellar digging, pit mining, loading, unloading, and handling materials, is described in the literature of the Keystone Driller Co., Beaver Falls, Pa.

### TWO TO EIGHT TON INDUSTRIAL LOCOMOTIVES

The Industrial Equipment Co., 910-916 Ohio street, Minster, Ohio, will be pleased to send a copy of its catalog describing Minster industrial locomotives for contracting service in any gage and from 2 to 8 tons capacity.

### CONTRACTORS' WHEELBARROWS

In Catalog No. 104, the Akron Barrow Company, Cleland, Ohio, describes in detail its complete line of contractors' wheelbarrows with extended nose braces which make the barrows practically indestructible.

### MOTOR DUMP TRUCK EQUIPMENT

In its new portfolio, "Road Building Equipment," the Heil Co., 1243 26th street, Milwaukee, Wis., describes a number of its complete installations of Heil dump bodies and hydro hoists for contractors.

### EVERYTHING FOR THE ROAD MAKER

The free catalog of the Good Roads Machy. Co., Inc., Kennett Square, Pa., describes its complete line of road machinery, covering everything that is needed by the road-building contractor.

### STEEL PAVING GUARDS

Steel paving guards to protect the edges of bituminous, concrete, and brick roads, are described in detail in literature which may be secured from the W. S. Godwin Co., Baltimore, Md.

### SPEED DUMP TRUCKS FOR ROAD WORK

The General Motors Truck Co., Pontiac, Mich., has announced a new one-ton dump truck which it is offering as a valuable aid to road builders. The details of this new truck are given in literature which may be secured from the manufacturers.

### TANDEM PAVING ROLLERS

Any contractor interested in a paving roller particularly adapted to handling asphalt paving work and able to do its bit on any paving job, should secure the illustrated catalog of the Erie Machine Shops, Erie, Pa.

### MAKING ASPHALT PAVING REPAIRS EASY

The Lutz surface heater made by the Equitable Asphalt Maintenance Co., 1901 Campbell street, Kansas City, Mo., and described in its literature is designed to soften asphalt and other bituminous pavements to facilitate repairs.

### WATER METERS FOR EVERY SERVICE

Disc meters in sizes from  $\frac{1}{8}$ -inch to 4 inches with intermediate train gears and pinions of monel metal are described in special bulletins issued by the Badger Meter Mfg. Co., 841-847 Thirtieth St., Milwaukee, Wis.

### HEAVY DUTY CONCRETE MIXERS

Free catalogs have been issued by the Koehring Co., Milwaukee, Wis., describing its various sizes of mixers. P-6 describes its pavers from 7 to 32 cubic feet capacity; C-6 describes its construction mixer of 10 to 28 cubic feet capacity, and D-6 describes the Dandle mixer of 4 and 7 cubic feet capacity.

### AN AUTO HEATER FOR TAR AND ASPHALT

The Kinney Mfg. Co., 3929 Washington street, Chicago, Ill., manufactures a patent combined auto heater and distributor for heating and applying bituminous materials to roads. This and the Kinney handy heater and sprayer for road maintenance work are described in literature which may be secured free on request.

### A CONCRETE ROAD BUILDER

The Dunn tamping machine, designed by road builders for road contractors handling concrete paving, is described in detail in literature which may be secured from the Dunn Road Machinery Co., Conneaut, Ohio.

### ROCK DRILLING EQUIPMENT

The literature of the Denver Rock Drill Mfg. Co., Denver, Colo., describes its complete line of Waugh drills, sharpeners, hoists and portable compressors.

### PNEUMATIC SURFACING TOOLS

The contractors' supply folder of the Thos. H. Dallett Co., Philadelphia, Pa., describes its complete line of hand and pneumatic surfacing and bushing tools which are in daily use by many contractors.

### LIGHT-WEIGHT JACKS

Bulletin 29, which will be sent on request to contractors by the McKiernan-Terry Drill Co., 19 Park Row, New York City, describes the Dough-boy jack, a light-weight jack made in sizes from 15 to 100 tons, and guaranteed to never turn around or back down.

### TRUSTY, HEAVY-DUTY GASOLINE ENGINES

The catalog of the Climax Engineering Co., 1 West 18th street, Clinton, Iowa, describes the Climax engine for moderate speed, heavy duty, developing 30 to 70 horse-power with kerosene or gasoline.

### STEAM ROAD ROLLERS WITH SCARIFIERS

Catalog A, issued by the Buffalo-Springfield Roller Co., Springfield, Ohio, describes in detail the complete line of steam and motor road rollers with scarifier attachments made by this company.

### JOBS HANDLED BY TRACTORS

The catalog and folders, issued by the C. L. Best Tractor Co., San Leandro, Calif., give complete information regarding jobs which Best tractors have handled profitably for contractors.

### A ONE-MAN EXCAVATOR

The Bay City Dredge Works, 2622 Center avenue, Bay City, Mich., manufactures a light, low-priced economical one-man excavator for clay, sand, and gravel pits, which is described in detail in literature which may be secured free on request.

### LIGHT-WEIGHT TRACTOR MODELS

In its descriptive literature, the Little Giant Co., 231 Rock street, Mankato, Minn., describes in detail the two models of Little Giant road tractors which are used extensively on contracting work.

**ASPHALT PAVING TOOLS**

The catalog and price list of Littleford Brothers, 500 East Pearl Street, Cincinnati, Ohio, lists its complete line of asphalt paving tools, including tampers, shovels, rakes, tool heaters, tar kettles, pouring pots, brick filling pots and carrying pots.

**ASPHALT MACADAM ROAD CONSTRUCTION**

The Asphalt Sales Department of the Texas Company, 17 Battery Place, New York City, has just issued a new revised Texaco asphalt macadam booklet which tells how to build an asphalt macadam road by the penetration method, with particular attention to the foundation and the wearing surface. This booklet includes diagrams and photographs, showing the different steps in the construction of asphalt macadam pavements.

**MOTOR ROAD ROLLERS**

A motor driven road roller, which is claimed to be superior to any steam type of road roller in efficiency, is described in detail in special catalog G, which may be secured from the Austin-Western Road Machinery Co., Chicago, Ill.

**BETTER-MADE SHOVELS FOR CONTRACTORS**

Shovels that are able to withstand severe shocks and strains and which have found favor with road contractors for many years, are described in the literature of the Pittsburgh Shovel Company, Pittsburgh, Pa.

**A SHORT WHEELBASE TRUCK FOR CONTRACTORS**

The economy of short wheelbase motor trucks of 2-3 and 4-6 tons capacity for all kinds of contracting work is told in an interesting manner in the literature of the Autocar Company, Ardmore, Pa.

**CONTRACTORS' LOCOMOTIVES**

An engine that is claimed to be the best, and which has a backing of 56 years of contractors' engine building and service, is described in detail in the literature of the H. K. Porter Company, Pittsburgh, Pa.

**SAVE STONE BY SPREADING EVENLY**

The Burch Stone Works Co., Department E, Crestline, Ohio, will be pleased to furnish information regarding the Burch stone spreader which lays gravel, slag or stone evenly at any required depth and width direct from the end of the truck.

**MOVING 300 YARDS OF DIRT A DAY**

Just how Roytrac Multi-Unit Wheel Scrapers easily moved 300 yards of excavation a day, is told in literature which may be secured from Smith & Sons, Mfg. Co., 1504 Guinotte Avenue, Kansas City, Mo.

**A NEW MODEL INDUSTRIAL TRACTOR**

A model "W" industrial Cletrac for road grading and similar work is described in literature which will be furnished on request by the Cleveland Tractor Co., 19211 Euclid Avenue, Cleveland, Ohio.

**EXPANSION JOINTS A NECESSARY SAFETY FACTOR IN ROAD BUILDING**

The literature of the Philip Carey Co., 9 Wayne avenue, Lockland, Cincinnati, Ohio, tells in detail why Elastite expansion joints are an absolute necessity in concrete and block pavements.

**AN ASPHALT SURFACE HEATER AND PATCHER**

The Hauck Manufacturing Co., 126-134 Tenth street, Brooklyn, N. Y., in its new building, 131-CM, describes in detail its asphalt surface heaters and patchers for contractors, city, street and highway departments.

**MORE PROFIT ON EXCAVATING WORK**

The T. L. Smith Company, 1018 32nd street, Milwaukee, Wis., has just issued a new folder, "More Profit on Your Excavating Work," which gives a dollars and cents comparison between the loading of excavated material by hand and with the Smith excavator.

**ASPHALT EXPANSION JOINTS**

Monolithic pavements need an expansion joint such as described in the literature of the Pioneer Asphalt Co., Lawrenceville, Ill., for protection against the expansion of the pavement due to heat.

**LADDER AND WHEEL TYPE TRENCH EXCAVATORS**

Long lived trench excavators of the wheel type and ladder type are described in detail in literature which may be secured from the Excavating Machy. Div., Pawling & Harnischfeger Co., 3819 National Avenue, Milwaukee, Wis.

**SAW RIGS FOR CONTRACTORS**

The complete catalog of the C. H. & E. Manufacturing Co., Inc., 500 Mineral Street, Milwaukee, Wis., describes its No. 14 saw rig outfit with steel frame and table.

**ELECTRIC POWER SHOVELS**

Bulletin 202, just issued by the Thew Shovel Company, Lorain, Ohio, describes in detail the Type 00 electric shovel which has recently been placed on the market by this company.

**A CEMENT WATER-PROOFING PAINT**

A sample of concrete treated with Cemcoat, together with color cards of floor and wall coatings, may be secured from L. Sonneborn Sons, Inc., 262 Pearl Street, New York, N. Y.

**CULVERTS THAT LAST**

Genuine open-hearth iron corrugated culverts in both round and half-round types for city and country use in draining areas beside highways, are described in booklets which may be secured from the Newport Culvert Co., 542 West Tenth Street, Newport, Ky.

**TRACTOR PERFORMANCE**

The Holt Manufacturing Company, Inc., Peoria, Ill., builders of tractors for road building and dirt-moving jobs, will send a copy of its new booklet, "Caterpillar Performance," to any interested contractors.

**STONE SCREENS AND STORAGE BINS**

The advantages of material-handling devices, including stone storage bins and screens, are described in the catalogs of the Weller Manufacturing Co., 1820-1856 North Kostner avenue, Chicago, Ill.

**UP-TO-DATE ASPHALT ROAD CONSTRUCTION**

In its illustrated booklet, Warren Brothers Co., Cambridge Street, Boston, Mass., describes up-to-date street and road construction by the use of Warrenite-bitulithic pavement.

**CAST IRON PIPE AND FITTINGS**

The U. S. Cast Iron Pipe & Foundry Co., Burlington, N. J., will be pleased to send its descriptive literature covering cast iron pipe for water, steam, and gas mains, and submarine lines in bell and spigot, flanged, plain end and flexible joint pipe, as well as on fittings and special castings.

**PROTECTIVE BARS FOR CONCRETE CURBS**

Protective bars which reinforce concrete curbs are described in detail in literature which may be secured from the Truscon Steel Company, Youngstown, Ohio.

**TIMBER CLAMPS FOR SCAFFOLDING**

The Schenk Timber Clamp Corporation, 501 Fifth Avenue, New York, N. Y., has issued some interesting literature on the Schenk timber clamp which securely fastens two pieces of timber together without chance of its slipping, thus making material savings in scaffolding and shoring costs.

**DRAGLINE CABLEWAY EXCAVATORS**

Dragline cableway excavators which dig, convey, elevate and dump in one operation, are described in an illustrated booklet which may be secured from Sauerman Brothers, 1143 Monadnock Block, Chicago, Ill.

**EXCAVATING GRADERS AND BLADE GRADERS**

In its well-illustrated catalog, the Russell Grader Mfg. Co., Minneapolis, Minn., describes in detail its 7 sizes of standard blade graders and two sizes of elevating graders used by contractors in all parts of the country on road work.

**WATER PAILS AND WASTE CANS**

In Ironhorse metalware catalog No. 921, the Rochester Can Co., Rochester, N. Y., gives the specific points regarding the strength and wearing qualities of various types of contractors' pails and rubbish cans.

**ADJUSTABLE STEEL WALL FORMS**

Reichert adjustable steel molds, which can be used on more than 500 buildings with only slight repairs, are described in the catalog of the Reichert Concrete Metal Forma Company, 1200 Weil Street, Milwaukee, Wis.

**PORTABLE SCOOP CONVEYORS**

In its special contractors' type conveyor bulletin, the Portable Machinery Co., Passaic, N. J., describes its portable belt conveyor which has proven so successful in contracting service for the handling of all kinds of abrasive materials, such as sand, gravel, crushed stone, etc.

## A New Shovel Dipper to Increase Yardage

**T**HE new Type Z, one-yard-capacity steam shovel dipper recently placed on the market by the Bay City Dredge Works, Bay City, Mich., for working in muck or among roots, has a number of features of interest to contractors. The dipper was patented by Michael J. Zabawa and has been thoroughly tried out in service since 1918 on dredges in Minnesota and Wisconsin. The novel shape, as shown in the illustration, enables the dipper to pick up a full load no matter what kind of material is being dug. It is claimed that it will pick up a larger load than the type of dippers now in general use. It dumps clean when handling sticky dirt, by tipping forward to spill the entire contents. It is not necessary to shake the material through a back or bottom door. This dipper



**A NEW STYLE TIPPING DIPPER**

picks up and dumps boulders, stumps, roots, and sod which would not pass through the ordinary bottom-dump dipper.



**A FULL LOAD AND THEN SOME**

## Street Machine Repairs in Winter

**J.** A. McLAUGHLIN, of J. S. McLaughlin & Sons, Makato, Minn., states in a recent issue of *The Constructor* that his company specializes in the construction of street and road paving and therefore does not operate other than a portable plant. They have concrete and asphalt plants with machinery sufficient to lay

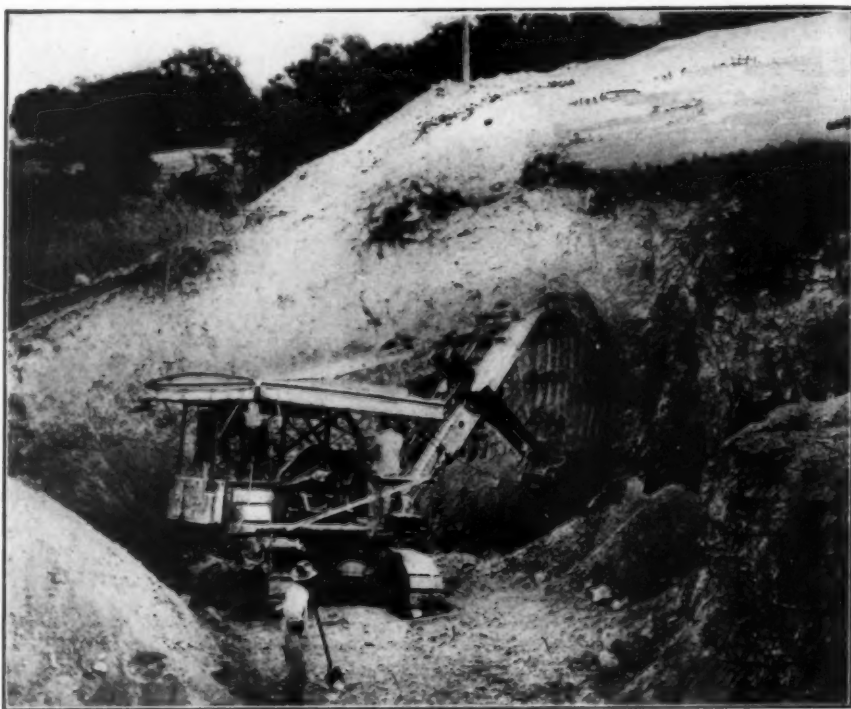
the various types of pavements. They did more repairing during the winter of 1921 and 1922 than in any previous season, because of the slack time, and tried in that way to help out the unemployment situation. They gave their machinery closer inspection and did work that might have gone by for another year.

## Equipment Used by Live Contractors

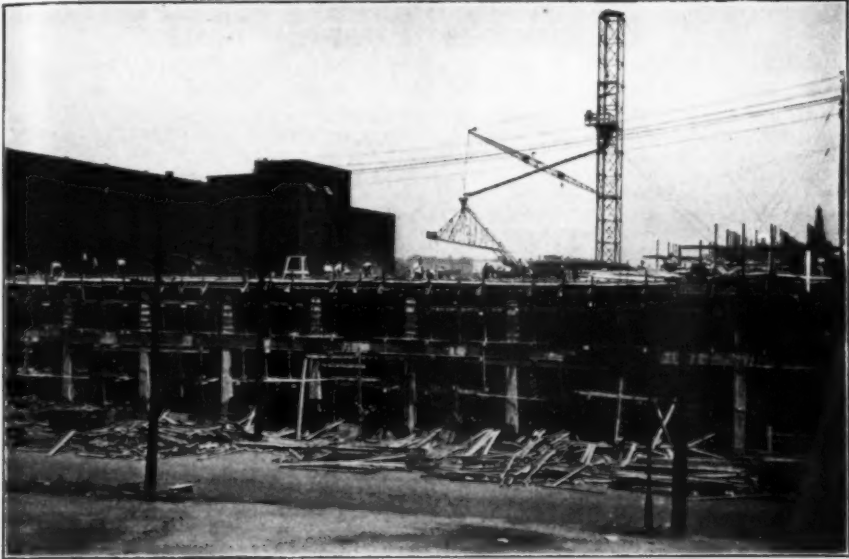


**A COMPLETE MOTORIZED ROAD-BUILDING UNIT OWNED BY THE SHIRLEY CONSTRUCTION CO., HANDLING A ROAD CONTRACT AT OMAHA, NEBB.**

The outfit consists of two Holt Caterpillar tractors, one hauling LaPlant-Ghoate 6-cubic-yard trailers and the other the elevating grader. Note the smooth road surface made possible by the completely motorized equipment and large capacity trailers which enable the outfit to work with a minimum of stops



**A PAWLING AND HARNISCHFEGER NO. 206 SHOVEL OWNED BY F. B. HILLS WORKING IN A QUARRY OF THE BERNAL MARL FERTILIZER CO, EDEN VALE, CALIF.**



**INSLEY STEEL TOWER QUICK SHIFT COUNTERWEIGHT CHUTING PLANT BEING USED ON A ST. LOUIS JOB**

The McCormack-Combs Construction Company, St. Louis, purchased this outfit from the Geo. F. Smith Co., for use on the Westinghouse Electric Co. job at 12th and Gratiot Streets, St. Louis



**AVERY 45-65 ROAD TRACTOR AND GRADER WORKING FOR JAHNIG & DAVIS, BRITTON, SOUTH DAKOTA, ON A FEDERAL AID ROAD JOB NEAR BRITTON**

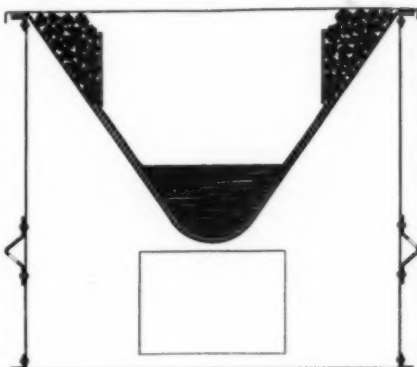


## A Continuous Roofing Kettle

New Features Speed Up Heating of Material

**A** DISTINCTLY new type of continuous roofing kettle, in which revolutionary ideas are embodied and which is claimed to effect great economies that will benefit roofers and other users of asphalt melting kettles, has been placed on the market by the Barber Asphalt Company, Philadelphia, Pa. This kettle will produce asphalt ready for the roof within ten minutes after the kettle is started, and provides a continuous supply of hot asphalt at all times. Under actual operating conditions, it has been found that less than 10 pounds of fuel are required for each 100 pounds of asphalt melted.

In addition to the reduction of the expensive item of fuel in kettle operation, it was found in a recent test that four minutes after the fire was started the asphalt from the side pockets shown in the accompanying illustration started to flow into the bottom of the



SECTION OF KETTLE SHOWING SEPARATION OF COLD AND HOT MATERIAL



A KETTLE OF DISTINCTIVE FEATURES

tank. Eight minutes after the kindling was ignited, the hot asphalt in the bottom of the tank was 2 inches deep, and in 15 minutes there was 6 inches of asphalt ready for the roof. This feature makes it possible to have the kettle men start heating the asphalt only a very short time before the roofers are ready, thus eliminating two or three extra hours' pay for overtime work. The continuous feature of the kettle, secured by the arrangement of the side pockets for the cold asphalt, where the material is warmed and from which it flows into the bottom of the tank, insures a supply of hot asphalt as long as the fire is kept burning. Cold material never comes in contact with the hot material, and therefore there are no cold lumps in the bottom of the tanks to delay the dipping out of hot material.

It is claimed that one Iroquois continuous roofing kettle will deliver as much hot asphalt as three ordinary kettles of the same capacity, but will consume only one-fifth the amount of fuel the other type kettles would require.

## Miscellaneous Notes

The Benham Engineering Company, Kansas City, Mo., have been retained as consulting engineers on the Bull Creek water project by the Board of Commissioners of McAlester, Okla. The dam on Bull Creek will be completed and the entire water problem will be worked out along a definite plan of development.

The Spears-Wells Machinery Company, 241 12th Street, Oakland, Calif., has been appointed an agency for handling in northern California the sales of Smith concrete mixers, pavers, excavators and loaders made by the T. L. Smith Company, Milwaukee, Wis.

## Chuting Concrete on Small Jobs

Equipment Which Has Reduced Costs on Big Contracts Made Available for Small Jobs

WHILE the use of chutes for placing concrete has been accepted as good practice for a number of years, it has usually been thought to be economical only when used on large jobs. This is due to the fact that there is more or less expense involved in erecting a tower heavy enough to carry chutes. There has been a need, therefore, of a small, inexpensive chuting plant for operations large enough to use chutes to advantage but too small to warrant the erection of a more or less elaborate plant.

To meet this need, the Insley Manufacturing Company, Indianapolis, Ind., has developed the mast hoist plant. This plant consists of an 8-cubic-foot capacity bucket mounted on steel angle guides, which in turn are mounted on a 12x12-inch wooden built-up mast. This bucket is of sufficient size to take care of all that a half-bag or one-bag mixer can turn out. A light angle head-frame is placed on the same guides as the bucket at whatever point it is desired to have the bucket dump. There is a small hopper on this head-frame sufficient to take care of the discharge of the bucket. The bucket is hoisted by means of a light hoist and automatically dumped by this head-frame. This is effected by means of an arrangement of two levers, a steel apron on the head-frame which bridges the distance between the hopper and the bucket, and a standard hopper gate on the bucket, which opens automatically.

The head-frame is provided with an angle which makes the chute connection. Swivel-head chutes are always hung from the head-frame. The mast is strong enough to support the bucket, the head-frame and about 30 feet of chutes.

The range of work on which this plant can be used to advantage is very wide. The average amount of concrete placed by the plant will run from 50 to 60 yards a day, but on several occasions as much as 90 yards has been placed daily for 8 or 10 days. The capacity, however, is limited only by the mixer, since the plant can deliver as much concrete as any one-bag mixer can mix.

Elevation of the head-frame can be easily changed

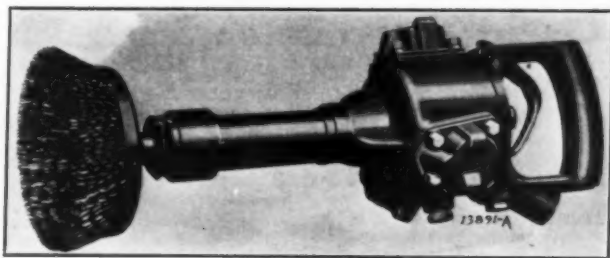
by riding the head-frame on the bucket to the desired height and bolting it in place. This is an advantage in two- and three-story work.

An additional feature of this plant is a small material elevator. This consists of a steel platform which is mounted on the guide angles in the same way as the bucket. Both are easily removed and changed about. This material hoist has sufficient room for a single wheelbarrow or concrete buggy, and can be used to good advantage to elevate brick, tile and other material. It is quite an addition to the plant, chiefly because it eliminates a separate elevator cage.

The whole plant, because of the light construction of the mast, can be easily dismantled and moved from job to job. It can be readily seen that in this plant all the advantages and economy of chutes are embodied, and it is a plant that will be very useful to a contractor who does smaller concrete construction.



A NEW INSLEY MAST HOIST IN USE POURING A CONCRETE FLOOR



RUST AND OLD PAINT CAN BE REMOVED IN A JIFFY WITH THIS BRUSH

## High-Speed Brush for Cleaning Metal Work

THE increasing use of air-driven wire brushes for cleaning metal surfaces has demonstrated the need of high rotating speed for the wire brush. Especially has this been true in such cleaning work as removing paint, rust, dirt or scale from tanks, steel cars, and structural steel forms where the area to be cleaned is large and a fast rate of work is required. It has been found that a wire brush turning at high speed cleans faster and also stands up under the severe service much better than if only rotating at 2,000 to 3,000 r. p. m. The Ingersoll-Rand Company, 11 Broadway, New York City, has recently brought out a high-speed cleaner, known as the No. 601 "Little David" wire brush, which has a maximum speed of 4,200 r.p.m. This machine has been found very successful in operation, effectively cleaning structural steel forms and also iron and steel castings. It has proved that it can not only do a good, thorough cleaning job, but can also bring about a considerable saving

of time and labor as well.

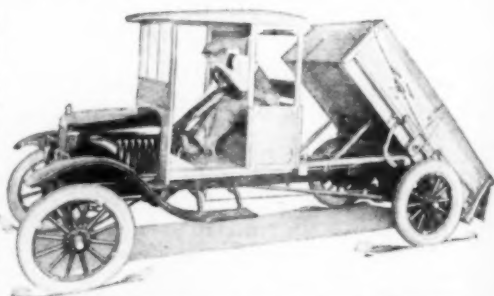
On a six-weeks' test this machine cleaned steel gondolas, each averaging 540 square feet of surface, in  $3\frac{1}{2}$  hours. All-steel box cars averaging 1,400 square feet of surface were cleaned in  $7\frac{1}{2}$  hours. The brush removed not only all the rust but the old paint as well, so that when repainted the cars looked practically as if new sheets had been applied. The air motor used on this wire brush cleaner is of the 3-cylinder type, such as used in "Little David" portable grinders, and has been thoroughly tested out in severe service. The machine is simple in construction and well balanced, and operates practically without vibration. Light weight has been obtained by using an aluminum casing reinforced with cast iron bushings. The weight of the complete machine is only 14 pounds. The average free speed at 90 pounds air pressure is 4,200 r.p.m. The length over-all is  $17\frac{1}{2}$  inches, and the diameter of the wire brush is 6 inches.

## A Universal Dump-Body for One-Ton Trucks

A NEW dump-body which is in reality a combination express and dump-body, particularly adapted for the use of contractors and builders, building material men and city departments needing dump-trucks, has been placed on the market by the Eagle Wagon Works, Auburn, N. Y.

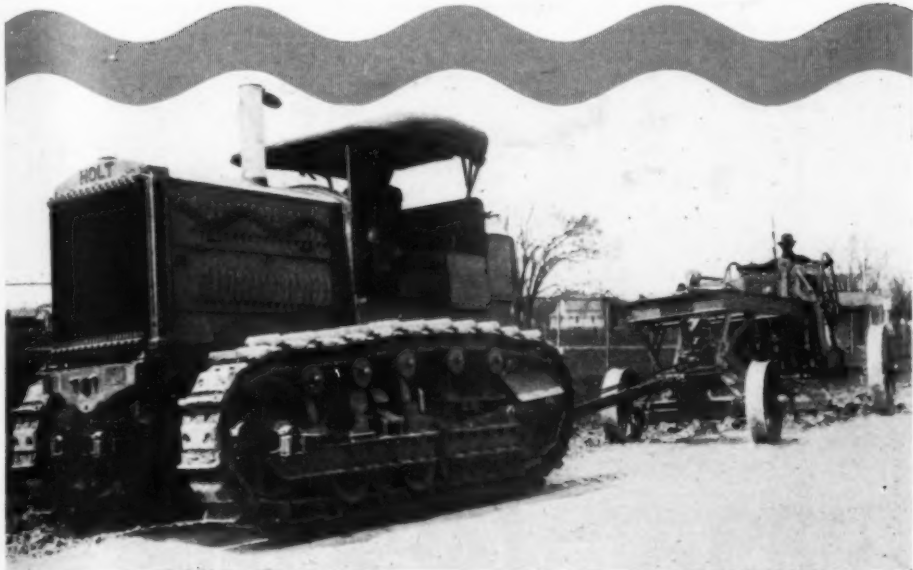
The dump-body has a capacity of  $1\frac{1}{4}$  cubic yards water-level or  $1\frac{1}{2}$  cubic yards round measure. The maximum slant obtained in dumping is 64 degrees when empty on level ground. The body weighs only about 510 pounds, the chassis parts 100 pounds, and the dumping device 85 pounds, making a total of 705 pounds additional weight on the regular one-ton chassis.

The dump-body operates entirely from the seat and can be dumped in three seconds or up to three minutes, if so desired. The tail-gate opens and closes and locks automatically. The



BODY MOUNTED AND IN DUMPING POSITION

dumping load can be slowed up or stopped entirely at any point of the dump by means of the foot brake. It can also be locked at any dumping angle.



SCARIFYING MACADAM BEFORE RESURFACING

## There Is No Substitute for "Caterpillar"\* Service

The "Caterpillar's" field of usefulness is by no means limited to dirt moving and public works. There is a "Caterpillar" of size and capacity for every power need. On farm or ranch, in the mining, oil and lumber industries, for snow removal, wherever tractive power and endurance are at a premium, the "Caterpillar" has no real competitor.

Not only are "Caterpillar" Tractors without an equal in compactness of design, staunchness of build, and consistent pulling power—they are backed everywhere by prompt *Holt Service*. Our branches and distributors maintain fully equipped service stations, that are *real* service stations, in all parts of this and foreign countries. Wherever street improvement, hauling or dirt moving projects are being put through, contractors, public officials and engineers find Holt Service within easy reach. Because it is complete and always accessible, Holt Service puts real significance into the guarantee under which every "Caterpillar" is sold. Let us send you interesting facts and figures or arrange a motion picture exhibition of "Caterpillars" at work.

\*There is but one "Caterpillar"—Holt builds it. The name was originated by this Company, and is our exclusive trade-mark registered in the U. S. Patent Office and in practically every country of the world.

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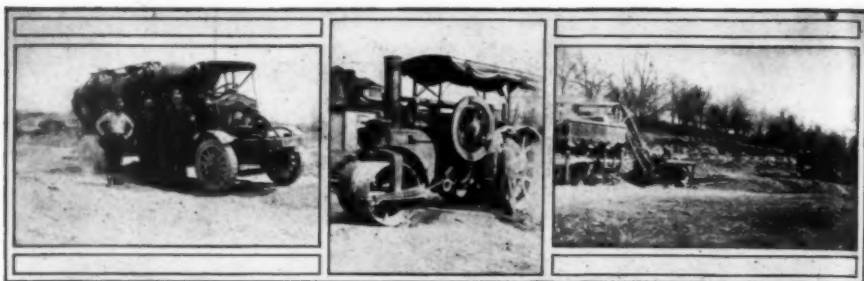
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ROAD BUILDING EQUIPMENT IN DAVIDSON COUNTY, TENN.

Left, Kinney oiler on 7-ton Kelly-Springfield truck; middle, Galion 2-cylinder, 12-ton gas roller; right, Telsmith Gyratory crusher and elevator operated by a Nichols & Shepard 20-horse-power traction engine

## Stone Production in Davidson County, Tenn.

Complete Equipment Produces Stone for County Highway Construction

THE Davidson County Highway Department, Nashville, Tenn., is using gyratory crushers entirely for producing crushed stone, as it has found in handling the local stone quarried near the surface that the gyratory crushers give a more uniform size stone than jaw crushers of equal capacity. The surface stone is in thin strata which have a tendency to pass through jaw crushers in flat slabs, and the circular crushing face of the gyratory crusher prevents much of this trouble.

The gyratory crushers are heavier to handle, requiring more work and more skill in setting up and more attention to lubrication and quality of lubricants than jaw crushers. Six No. 4 Telsmiths and one No. 3 Telsmith gyratory crusher are used, and two more No. 4 crushers have been installed for use this spring. Experience has shown that one feeder is saved in using the gyratory type of crusher. A knock-down incline feeding platform is built and dump-carts are used, dumping directly into the crusher.

A complete road-working outfit as used by Davidson County, Tenn., is made up as shown in the table below. There are 15 of these units in operation at present:

- 1 20-horse steam traction engine
- 1 bin (15-20 ton)
- 1 crusher (No. 4 Telsmith 11 x 20 jaw)
- 2 dump-carts
- 1 grader (8-foot)
- 1 gasoline pump
- 1 water wagon
- 1 sprinkler (horse-drawn)
- 1 10 or 12-ton roller; gasoline later purchases, steam former purchases
- 1 5-ton truck

Each crew consists of the following men:

	Hours' Work	Per Day
Foreman	9	\$4.50
Roller engineer	9	4.50
Truck driver	9	3.50
Traction engineer	9	3.50
2 rock spreaders	9	2.50 each
2 crusher feeders	9	2.50 each
4 loaders	9	2.50 each
1 team with driver for sprinkling wagon		5.00
2 mules for carts with driver for each		3.75
Average gallons gasoline for truck, 105 gallons for 6 days		
Average quarts motor oil for truck, 30 quarts		
Average pounds hard grease for truck, 1½		
Average quarts of lubricating oil for gas roller, 16		
Average gallons gasoline for gas roller, 110		
Average bushels coal for steam roller, 120		
Average quarts lubricating oil for steam roller, 6		
Average bushels coal for traction engine, 90		
Average quarts lubricating oil for traction engine, 24		
Average gallons crusher oil for crusher, 9		
Average quarts lubricating oil for water pump, 3		
Average gallons gasoline for water pump, 6		

This outfit handled between 90 and 100 yards of crushed stone up to one mile haul from the crusher to the road.

At the end of November, 1921, there were 189.2 miles of oiled roads as compared with 132.2 the year before, making a total of 57 miles which were oiled during 1921. The work during the final quarter of the year was held up materially by wet weather and lack of funds in a number of road districts. Concrete culverts were completed in a number of the districts and heavy stone excavation on the Harding Pike was very nearly completed.

J. C. Creveling, Jr., is Chairman of the Davidson County Highway Commission, of which Charles H. Simpson and S. R. Johnson are members. W. O. Denny, Secretary, and S. G. Marshall, Superintendent.

### Who Makes Hand Shovels?

Frequently you are confronted with the question of who makes a specific kind of equipment. By consulting the "Where to Purchase" directory beginning on page 3 of the CONTRACTORS' AND ENGINEERS' MONTHLY your query is quickly answered.



Laying 12-inch  
"Universal"  
under Lehigh  
River



# UNIVERSAL CAST IRON PIPE

*tight and flexible—no packing, no calking; no bell holes*

## 28,000 Feet

of Universal Cast Iron Pipe laid by the South Easton Water Co. for Easton, Pennsylvania, is giving perfect service. Part of the installation is a submerged line under the Lehigh River.

Submerged lines may be economically laid with Universal Pipe.

They may be laid from a skid or by bolting up sections and connecting up by a diver on the bottom. The bolts are temporary.

After the joints have been drawn together the bolts have performed their function—*wrenches the only tools.*

You are not fully posted unless you have complete data on "Universal"—the cast iron pipe with the machined hub and spigot ends. The highest development in cast iron pipe. Used the country over for dependable water supply, fire protection and other service where freedom from leakage is essential.

Write nearest office for complete information.

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New Address: 41 East 42nd Street, New York

Sales Offices: New York, Chicago, Birmingham, Dallas, San Francisco

469

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## A Midget Tar and Asphalt Heater

**C**ONTRACTORS and engineers concerned with the building of modern highways or responsible for their maintenance will be interested in the new Midget No. 69 tar and asphalt heater for road and street maintenance, recently placed on the market by Littleford Brothers, 500 E. Pearl Street, Cincinnati, Ohio.

This small-sized maintenance heater, having a capacity of 25 gallons, has all the features of the regular-size No. 69 heater, except that it is lighter and more easily handled by one man. It is particularly adapted to road patrolling where a larger and heavier kettle is not desirable. A convenient drain is provided at the rear, where the valve is kept warm because of its close proximity to the fire-box. The construction of the heater is claimed to be exceptionally durable. The large fire-box is fitted with renewable cast iron grates, and the furnace shell is protected by liners of fire-box steel. The rectangular kettle itself is removable. The seams are heavily welded, thus eliminating all possibility of leaks and danger of fire. A removable cover is provided for the kettle itself.

The Midget heater is mounted on two all-steel wheels 18 inches in diameter with 2 x 3/4-



A LITTLE FELLOW THAT SAVES MONEY

inch flat tires. The axle is 1 1/4 inches in diameter. A rugged handle, well-braced and fitted with a stiff leg, is attached to the front end at a convenient height for drawing the heater about by hand to the various parts of the job.

## A New and Larger Motor for Excavator and Loader

**T**HE consistent service provided by Wisconsin four-cylinder gasoline engines used on pavers manufactured by the T. L. Smith Company, Milwaukee, Wis., has led

to the adoption of this motor on Smith excavators and loaders. The new motor, shown mounted in the accompanying illustration, has a 3-inch bore and a 5-inch stroke and runs at 1,200 r.p.m. This new unit provides about 40 per cent additional power over that of the previous equipment.



SMITH EXCAVATOR AND LOADER ON GRAVEL PIT WORK

The second illustration shows one of the excavators and loaders with the new motor on it, operating in excavating and loading from a gravel-pit. The loaded scraper is brought to the excavator and dumped directly into the waiting truck. Smith excavators and loaders are used for drag-line excavating, for digging basements and loading directly into wagons or trucks on the surface, and also for grading, stripping and miscellaneous earth-handling and loading operations.

**Repair Your Streets with  
THE LUTZ SURFACE HEATER**

It softens asphalt and other bituminous pavements. It vulcanizes the old and new material into a perfect bond. It cements Asphalt on Granite, Brick, Cobble, or other hard pavements. It makes re-surfacing and maintenance easy and inexpensive.

*Illustrated Particulars on Request*

**Equitable Asphalt Maintenance Co.**  
1901 Campbell St. Kansas City, Mo.



Repairing an Asphalt Pavement, New York

# PITOMETER SURVEYS

FIND LEAKS AND STOP WATER WASTE

52 CHURCH ST. PITOMETER COMPANY NEW YORK CITY

## WARRENITE BITULITHIC MEANS UP-TO-DATE

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Let your calculations be based on a "years of life" instead of a "low cost per gallon" basis.

Rust, decay, the action of fumes, acids and alkalies are adding unreasonable figures to your depreciation account daily if buildings and equipment are not protected with a standard reliable protective paint.

We will gladly send Booklet No. 148-B which tells about Dixon's Silica-Graphite Paint—Nature's combination of flake silica-graphite made into the most elastic, longest-lasting paint known.

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JERSEY CITY, NEW JERSEY



Established 1827



## SPAVINAW WATER PROJECT---TULSA, OKLAHOMA

### *Preliminary Notice to Contractors*

The Water Commission of the City of Tulsa, Oklahoma, contemplates receiving proposals during the last half of September for the construction of the Spavinaw Water Supply Project, for which \$6,800,000 bonds have been voted.

The work contemplated consists of a masonry and earth dam 50 feet high, 38 miles of 60-inch and 35 miles of 54-inch pipe, a 78-inch tunnel 7,000 feet long, a 350,000,000 gallon storage reservoir, a 10,000,000 gallon high pressure reservoir, and approximately 7 miles of cast iron or steel force mains.

Plans and specifications will not be entirely completed before August 15th, but are now far enough advanced for contractors who contemplate bidding to look over the work. The engineers for the project are prepared to show intending bidders the location of the various works upon the ground and to give detailed information. Contractors contemplating inspecting the work should notify the engineers as far in advance as possible.

Formal Notice to Contractors will appear in this publication upon the completion of the plans.

**Trummell & Holway, Engineers**  
339 Kennedy Building,  
Tulsa, Oklahoma

**Dabney H. Maury, Consulting Eng.**  
Chicago, Ill.

The Water Commission of the City of  
Tulsa

By **A. J. Rudd**  
Chairman



# KOEHRING

*the*  
**Heavy Duty  
Mixer**

**T**ERRIFIC strains throughout a mixer when the charging skip starts! Less strain on the Koehring because the Koehring skip cables get a more perpendicular "pull".

—and the Koehring skip goes to the high charging angle that shoots material into the drum in a swift, clean slide, without need for pounding skip against the frame.

#### CAPACITIES

**Construction Mixers:** 10, 14, 21, 28 cu. ft. mixed concrete. Write for Catalog C-6.

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**Dandle:** Light mixer, 4 and 7 cu. ft. mixed concrete; power charging skip, or low charging platform. Light duty hoist. Write for Catalog D-6.

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## Quick Interchangeability— New Control Flexibility and Time Saving Accessibility

**T**O change from clam shell work to drag line—just change the bucket. No gearing or drums to change. No rebuilding! Simply shift clutch for proper line speed for either job.

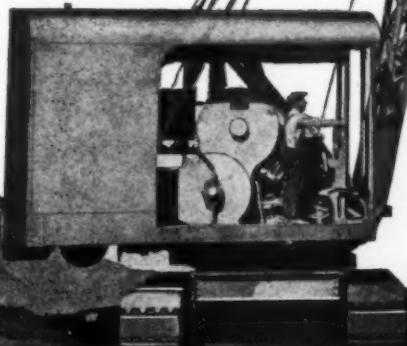
Shafts can be lifted from bearings without disturbing other parts—a new standard of accessibility. Boom the bucket in and out, and elevate or lower bucket, and travel all at once if you wish—and you can do it with the Koehring without the penalty of excessive wear. The greater flexibility of the Koehring means greater yardage handled.

—and it's Koehring heavy-duty built.

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### Capacities

**No. 2** Lifting capacity 24,000 lbs. at 12 ft. radius. Standard boom, 35 ft. long.

**No. 3** Lifting capacity 40,000 lbs. at 12 ft. radius. Standard boom, 45 ft. long. Boom length can be made to suit conditions.



# Distributors of Contractors' Equipment

THE following cards, (arranged by states) show the names of dealers in contractors' equipment and supplies with a record of the various lines handled. Contractors will find this list a convenient means of getting in touch with dealers who make a point of giving satisfactory service and prompt shipments. This directory is constantly consulted by our subscribers and any suggestions regarding it will be welcomed.

## ALA.



### REPRESENTING

"McMYLER" Loco. Cranes, Grab Buckets  
 "HAYWARD" Orange Peel Buckets  
 "CLIPPER" Blast Hole Drills  
 "RANSOME" Concrete Mixers  
 "HAISS" Portable Loaders  
 "CLYDE" Derricks, Hoists  
 "ERIE" Steam Shovels  
 "KENNEDY" Crushers  
 and  
 Allied Equipment

## ALA.—CALIF.

### JOHN D. TURNER COMPANY

BIRMINGHAM, ALABAMA

### CONTRACTORS' EQUIPMENT

Clam Shell Buckets	Excavators
Concrete Mixers and Pavers	Hoists
Concrete Chuting Plants	Industrial Cars
Cranes	Industrial Truck
Drag-lines	Pumps

### C. B. DAVIS ENGINEERING COMPANY

Brown Marx Bldg. Birmingham, Ala.

CRANES	CRUSHING EQUIPMENT
HOISTS	DREDGES
CONVEYORS	PUMPS
BELTS	BUCKETS

### THE YOUNG & VANN SUPPLY CO.

BIRMINGHAM, ALA.

### Contractors' and Industrial Equipment

#### DISTRIBUTORS OF

Rex Concrete Mixers and Pavers  
 Concrete Spouting and Handling Equipment  
 Nova Hoisting and Pumping Outfits  
 Wyoming Red Edge Shovels and Picks  
 Blaw Clam Shell Buckets  
 Blaw Steel Forms  
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 Browning Locomotive Cranes  
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New  
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### SOUTHERN STATES MACHINERY CO.

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 Aurora Pump & Mfg. Co.  
 Williams Clam Shell Buckets  
 Plymouth Gasoline Locomotives  
 Keystone Well Drills  
 Foote Multi-Foote Pavers  
 Thew Automatic Shovels  
 O. & S. Locomotive Cranes  
 Compressors

### "EVERYTHING for CONCRETE"

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 Apex Tilting Mixers  
 Blystone Shovel Mixers  
 Hobbs Block Machines  
 Building Tile Machines  
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 Shovels, Scoops, Wheelbarrows,  
 Concrete Workers' Hand Tools

### CONCRETE MACHINERY & SUPPLY COMPANY

2014 Santa Fe Ave.,  
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## MONEY MAKING MACHINERY

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## GARFIELD & CO.

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J. S. Mundy Hoisting Equipment

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## EDGAR ALEXANDER

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### REPRESENTING

Koehring Company, Milwaukee, Wis., Concrete Pavers, Mixers, Locomotive Cranes, Bar Cutters, Bar Benders, etc.

J. S. Mundy Hoisting Engine Co., Newark, N. J., Hoists, Derricks, Contractors' Equipment, etc.

C. H. & E. Mfg. Co., Milwaukee, Wis., Pumps, Saw Rigs, Contractors' Equipment, etc.

Construction Machinery Co., Waterloo, Iowa, Wonder Mixers, Hoists, Pumps, Backfillers, etc.

Evinrude Motor Company, Milwaukee, Wis., Evinrude Centrifugal Pumps.

Universal Road Machinery Company, Kingston, N. Y., Reliance Crushers, Street Sweepers, Oilers, Car Unloaders, etc.

Burch Plow Works, Crestline, Ohio, Stone Spreaders, etc.

George D. Whitcomb, Rochelle, Ill., "Locomotives".

Blaw-Knox Company, Pittsburgh, Pa., Road Forms, Bins, Batches, Turntables, Clamshell Buckets.

Also other lines including Steel Forms, Hoist Tower equipment, etc.

## THE 'AUSCO' LINE

Concrete Mixers and Pavers. Concrete Chuting Plants. Gas and Steam Hoists. Steam Pile Hammers. Revolving Cranes. Dragline Excavators. Steam Shovels. Road Forms. Car Unloaders. Crushing Plants and Quarry Equipment. Air Compressors and Pumps. Gas Locomotives. Industrial Tracks.

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... EQUIPMENT ...**

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Miami Trailer Co., Miami Trailers.

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STEAM SHOVELS, LOCOMOTIVES,  
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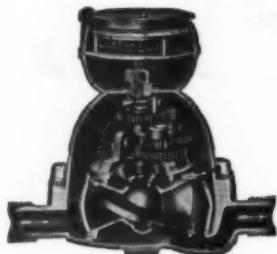
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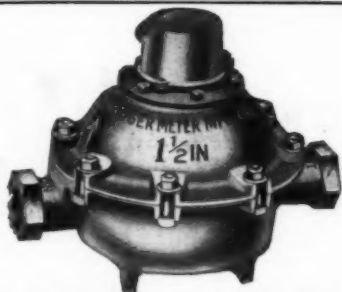
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## INDEX TO ADVERTISERS

After referring to the "Where to Purchase" Section, on pages 3 to 38, if you will look up the advertisements as per index below, you will be able to secure further data (with illustrations in many cases) on the material or equipment relative to which you are seeking information.

Acme Road Machy. Co. ....	36	Frale, Lawrence V. ....	82	Olmsted & Co., H. G. ....	93
Alexander, Edgar. ....	77	Fuller & McClintock. ....	93	Olsen, Olek. ....	80
American Park Builders. ....	92			Olsen, O. ....	93
Anderson Bros. Mfg. Co. ....	14	Gannett, Seelys & Fleming. ....	93	Patterson, Jno. W. ....	87
Anderson Tool & Sup. Co., W. H. ....	80	Garfield & Co. ....	77	Pattison Supply Co., W. M. ....	85
Archer & Co., E. T. ....	92	George & Co., Inc., E. ....	83	Pease Laboratories, Inc. ....	93
Armstrong & Co., Archer. ....	82	Giles & Ransome. ....	87	Pennsylvania Cement Co. ....	14
Ashmead, Henry C. ....	76	Glaeser, Frederick. ....	93	Pioneer Asphalt Co. ....	73
Ashworth, F. K. ....	92	Godwin Co., W. S. ....	22	Pitometer Co. ....	30
Austin Machinery Co., W. E. ....	77	Good Roads Machinery Co. ....	24	Pittsburgh Shovel Co. ....	30
Austin-Western Road Machy Co. ....	30	Good Roads Supply Co. ....	81	Pollock, C. D. ....	93
Autocar Co. ....	42	Graves Machinery Co. ....	78	Porter Co., H. K. ....	28
		Green Machy. Co., L. A. ....	87	Potter, Alexander. ....	93
Bacon Co., R. R. ....	77	Greisen-Matthaei Co. ....	78	Potts, Clyde. ....	93
Badger Meter Mfg. Co. ....	96	Grey Steel Products Co. ....	90	Queen City Supply Co. ....	84
Baker Mfg. Co. ....	22	Gross Hardware & Supply Co., P. ....	90		
Banks & Craig. ....	92			Raymer Equipment Co. ....	81
Barber Asphalt Co. ....	100	Haetten & Co., J. E. ....	90	Realing Engineering Co., Inc. ....	83
Barrett, Thos. L. ....	79	Haise Mfg. Co., Geo. ....	28	Rebhann-Smith Co., Inc., P. W. ....	83
Bay City Dredge Works. ....	12	Halloran-McLean Tractor Co. ....	88	Reichert Metal Concrete Forms	38
Becker & Becker. ....	80	Hansen, A. R. ....	93	Co. ....	77
Bentley, E. W. ....	77	Harris, R. L. ....	88	Rix Compressed Air & Drill Co. ....	96
Berkeley, W. N. ....	92	Harrison, Merts & Emlen. ....	93	Rochester Can Co. ....	81
Best Tractor Co., C. L. ....	36	Hazzen, Whipple & Fuller. ....	93	Roshalt Co., T. W. ....	94
Boeck-Lowe Machy. Co. ....	89	Hill Co., The. ....	36	Rossiter Co., Edgar A. ....	87
Borchert-Ingersoll Co. ....	81	Higgins, J. W. ....	93		
Bowe, Thos. F. ....	79	Hill & Ferguson. ....	92	Sanders & Sweeney. ....	93
Brandels Machinery & Supply Co. ....	79	Hillsman Co., G. E. ....	78	Sauerman Bros. ....	14
Brewster & Williams, Inc. ....	84	Hobbs, L. F. ....	89	Shannon & Co., Jacob J. ....	87
Brooks Co., R. R. ....	82	Holt Manufacturing Co. ....	69	Shunk Manufacturing Co. ....	18
Brown, Fraser & Co. ....	89	Holway Engineering Co. ....	93	Smith, Booth-Usher Co. ....	77
Brown, Herman M. ....	79	Hopkins & Field. ....	93	Smith & Co., C. E. ....	94
Brown, Thos. M. ....	80	Houston, J. C. ....	84	Smith & Sons Mfg. Co. ....	14
Brown & Siles Co. ....	82	Hubbard-Floyd Co., Inc. ....	80	Smith Co., Geo. F. ....	83
Buffalo-Springfield Roller Co. ....	28	Hunter Machy. Co. ....	89	Smith Co., T. L. ....	8
Buhl Machine Co. ....	78	Hyland Co., R. H. ....	78	Snare Corporation, Frederick. ....	92
Burch Plow Works. ....	18			Somers Filter & Todd Co. ....	88
Burnap, George. ....	92	Industrial Equipment Co. ....	22	Southern State Machinery Co. ....	78
				Standard Oil Co. of Indiana. ....	39
Cameron & Barkley Co., Inc. ....	77	Johnson, H. E. ....	86	Standard Supply and Equip. Co. ....	87
Carey Co., Philip. ....	16	Johnson Co., Inc., Geo. A. ....	94	Steinman, Dr. D. B. ....	94
Carlin Machy. Co., J. H. ....	87			Superior Supply Co. ....	79
Central Foundry Co. ....	89	Kastenhuber & Anderson. ....	93	Sykes Company. ....	85
Chadwick Bros. Co. ....	71	Kelker, De Leuw & Co. ....	93		
C. H. & E. Mfg. Co. ....	1	Keystone Driller Co. ....	26	Terry & Trench Co., The. ....	92
Chester Engineers, J. N. ....	92	King, Philip T. ....	84	Terry Mfg. Co. ....	12
Clark, Watson G. ....	92	Kinney Mfg. Co. ....	34	Texas Co., The. ....	10
Clark Co., H. W. ....	94	Koehring Co. ....	74	Thew Shovel Co. ....	32
Cleveland Tractor Co. ....	6	Kuhlman & Co., W. A. ....	86	Thomas, O. P. ....	94
Conard & Busby. ....	94	Kuhn, Frank J. ....	81	Tripp, B. Ashburton. ....	94
Conboy Co., John A. ....	86			Truscon Steel Co. ....	18
Concrete Machy' & Supply Co. ....	76	Landreth, O. H. ....	93	Tucker Co., Geo. O. ....	79
Connelly Machinery Co. ....	82	Lane Co., T. J. ....	85	Tucker-Day Machy. & Supply Co. ....	88
Conney & Co. ....	36	Layman, E. F. ....	93	Turner Co., C. ....	88
Contractors Trading Co. ....	83	Leison Co., T. H. ....	84	Turner Co., J. D. ....	76
Coulter, Waldo S. ....	92	Littleford Bros. ....	22		
Cox, H. L. ....	86	Little Giant Co. ....	14	Union Water Meter Co. ....	96
Curd Equipment Co., Geo. B. ....	85	London Concrete Machy. Co., Ltd. ....	96	Urdi Co., G. ....	94
		Ludlow Valve Mfg. Co. ....	96	U. S. Cast Iron Pipe & Fdy. Co. ....	91
Dallat Co., Thos. H. ....	30			Vermeule, Cornelius C. ....	94
Davis Engineering Co., C. B. ....	76	Mandell, T. H. ....	93	Wallace Equipment Co. ....	81
Davis Equipment Co. ....	83	McKenna Co. ....	85	Wallace & Tiernan Co., Inc. ....	96
Denver Rock Drill Mfg. Co. ....	18	McKenzie, L. S. ....	82	Ward Co., Lee T. ....	87
Dewey Supply Co. ....	83	Mackintosh Engineering Co. ....	85	Waring-Underwood Co. ....	18
Dixon Crucible Co., J. ....	73	Martin Machinery Co., R. A. ....	82	Warren Bros. ....	73
Dodge, C. R. ....	80	McClure Green Hngr. Co. ....	93	Weller Mfg. Co. ....	20
Dopp & Co., J. W. ....	80	McGraw-Hill Co. ....	2	Wetlaufer Bros. ....	81
Donlist & Williams Co., Inc. ....	92	McKiernan-Terry Drill Co. ....	12	Whayne Supply Co., R. C. ....	79
Draper, R. S. ....	92	Menge Pump & Machy. Co. ....	79	Whinery, S. B. ....	84
Dunn Road Machy. Co. ....	4	Meyer Co., Henry H. ....	80	White, Gilbert C. ....	90
		Midwest Laboratories. ....	93	Wiegand Bros. ....	90
Earnest Bros. ....	80	Mills Contractors Equip. Co. ....	88	Williams Co., W. W. ....	85
Edelen & Co., Inc. ....	86	Moore, A. B. ....	28	Wilson Machinery Co., J. Walker. ....	86
Ehrbar, Inc., Edward. ....	83	Municipal Supply Co. ....	28	Wilson-Wessner Co. ....	89
Engineering News-Record. ....	2			Wilson, W. R. ....	84
Equipment Corp. of Am. ....	78	National Supply Co. ....	86	Yancey Bros. ....	78
Equitable Asphalt Maint. Co. ....	73	Nat'l Water Main Cleaning Co. ....	26	Young & Vann Supply Co. ....	76
Erie Machine Shops. ....	28	Nelson, W. A. ....	88		
		Neptune Meter Co. ....	97	Ziegler & Co., Inc., Wm. H. ....	94
Fife Equipment Co., Geo. W. ....	79	Newport Culvert Co. ....	40	Ziegler Machy. Co., Geo. W. ....	88
Forchner, Alfred J. ....	86	N. Y. Testing Laboratories. ....	94		
Ford Meter Box Co. ....	94	Nixon-Hasselle Co. ....	88		
Forsythe Bros. ....	83				

93  
80  
93

87  
85  
93  
14  
20  
73  
30  
93  
28  
93  
93

84

81  
83  
83

38  
77  
96  
81  
94  
87

93  
14  
87  
18  
77  
94  
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82  
8  
92  
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87  
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94  
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18  
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88  
76

96  
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91  
94

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90  
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86  
89  
84

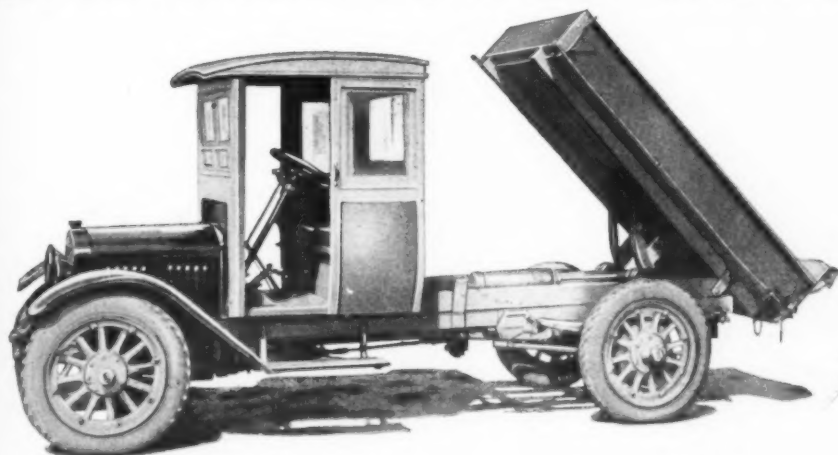
78  
76







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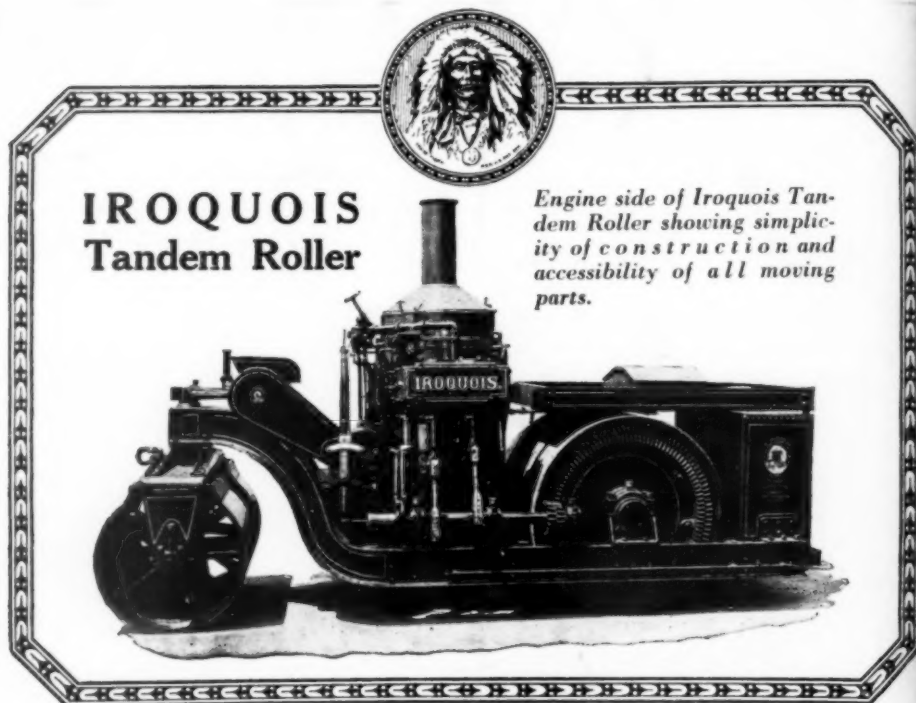
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